TECHNICAL SUPPORT FOR
ROCKY MOUNTAIN ARSENAL

FINAL
HUMAN HEALTH EXPOSURE ASSESSMENT FOR ROCKY MOUNTAIN ARSENAL STUDY AREA EVALUATIONS VOLUME VI-C SOUTHERN STUDY AREA EXPOSURE ASSESSMENT VERSION 4.1

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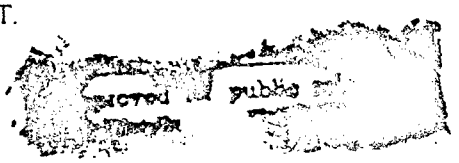
U.S. ARMY PROGRAM MANAGER'S OFFICE
FOR THE ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP



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13. ABSTRACT (Maximum 200 words)

THE OBJECTIVES OF THE HUMAN HEALTH EXPOSURE ASSESSMENT INCLUDE:

1. ESTIMATE THE TYPE AND MAGNITUDE OF EXPOSURES TO CONTAMINANTS
2. IDENTIFY CONTAMINANTS OF CONCERN
3. IDENTIFY SITES FOR REMEDIAL ACTION
4. RECOMMEND SITES FOR THE NO ACTION REMEDIAL ALTERNATIVE
5. PROVIDE A BASIS FOR DETAILED CHARACTERIZATION OF THE RISK ASSOCIATED WITH ALL SITES.

THIS DOCUMENT CONSISTS OF THE FOLLOWING: AN EXCUTIVE SUMMARY. VOL.I - LAND USE AND EXPOSED POPULATION EVALUATIONS. VOL.II & III - TOXICITY ASSESSMENT (INCLUDES ARMY AND SHELL TOXICITY PROFILES). VOL. IV - PPLV METHODOLOGY. VOL. V - PPLV CALCULATIONS. VOL. VI - STUDY AREA EXPOSURE ANALYSIS (A INTRODUCTION, B WESTERN STUDY AREA, C SOUTHERN STUDY AREA, D NORTHERN CENTRAL STUDY AREA, E CENTRAL STUDY AREA, F EASTERN STUDY AREA, G SOUTH PLANTS STUDY AREA, AND H NORTH PLANTS STUDY AREA. VOL. VII - SUMMARY EXPOSURE ASSESSMENT. VOL. VIII -

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LIST OF ACRONYMS

CAR	Contamination Assessment Report
COC	contaminant of concern
COS	contaminant of significance
CRL	certified reporting limit
EI	exposure index
ICP	Inductively Coupled Plasma
ISCLT	Industrial Source Complex Long Term Plume Dispersion
PPDDE	2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
PPDDT	2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane
PPLV	preliminary pollutant limit value
RI	remedial investigation
RMA	Rocky Mountain Arsenal
RMACCPMT	Rocky Mountain Arsenal Contamination Control Program Management Team
SAR	Study Area Report
SPPPLV	single pathway preliminary pollutant limit value
SSA	Southern Study Area
VEI	vapor exposure index

EXECUTIVE SUMMARY

The Southern Study Area (SSA) Exposure Assessment presents detailed exposure analyses for the 17 potentially contaminated areas defined by the Southern Study Area Report (SAR). The evaluations were based on the soil and sediment contaminant concentrations presented in the site-specific Contamination Assessment Reports (CARs) and the overall SARs and groundwater contaminants from DP Associates Groundwater Database. The maximum concentrations for each contaminant detected were extracted from these data and reported. Draft preliminary pollutant limit values (PPLVs) were computed for each of these site-specific contaminants as described in Volume IV of the Exposure Assessment Report for the direct (soil ingestion, suspended particulate inhalation, and dermal contact) and indirect (open and enclosed space vapor inhalation) exposure pathways. Cumulative PPLVs were computed for the five exposed populations (regulated visitors, casual visitors, recreational visitors, commercial workers, and industrial workers). The site-by-site evaluations consisted of comparisons of the maximum site contaminant concentrations to their corresponding cumulative Draft PPLVs in order to determine exceedances and, hence, established a first screen for determining sites which may be considered as candidates for remedial action during the Feasibility Study. These are ranked into two categories: Priority 1 which consists of sites where available soil contaminant concentration data indicate that the maximum detected concentrations exceed the draft human health based criteria, and Priority 2 which consists of sites where available soil contaminant concentration data indicate that the maximum detected concentrations do not exceed the draft human health based criteria. Site designations will be reconsidered throughout the Endangerment Assessment process as health based criteria are refined and additional data become available.

A groundwater plume has been identified in the SSA. Therefore, in addition to the direct soil exposure evaluations, the significance of the inhalation of volatile groundwater contaminants which diffuse through site soils was estimated using the open space and enclosed space vapor inhalation models as described in detail in Volume IV (Sections 4.5 and 4.6, respectively) and the exposure analysis procedures presented in Volume VI-A.

The exposure evaluations were performed for the most sensitive exposed population (i.e., the industrial worker).

Of the 17 sites evaluated in the SSA, 13 were designated Priority 1 sites based on the most sensitive exposed population PPLV (i.e., the industrial worker). These include:

- Eastern Upper Derby Lake (SSA-1a)
- Upper Derby Lake (SSA-1b)
- Lower Derby Lake (SSA-1c)
- Rod and Gun Club Pond (SSA-1d)
- Lake Ladora (SSA-1e)
- Drainage Ditches (SSA-2a)
- Sand Creek Lateral (SSA-2b)
- Drainage Ditch and Overflow Basin (SSA-2c)
- Buried Lake Sludge (SSA-3a)
- Buried Lake Sludge (SSA-3b)
- Trash Dump (SSA-4)
- Havana/Peoria Streets - Ponds and Ditches (SSA-5b)
- Section 11 - Ulvalda Ditch (SSA-5e).

Of the 17 sites evaluated in the SSA, 4 were designated Priority 2 sites based on the most sensitive exposed population PPLV (i.e., the industrial worker). These include:

- Lake Mary (SSA-1f)
- Section 1 - Dibromochloropropane Detection (SSA-5a)
- Section 12 - Lead Detection (SSA-5c)
- Section 12 - Lead Detection (SSA-5d).

The contaminants of concern (COCs) in soils (i.e., those displaying cumulative exposure indices (EIs) greater than 0.1) for the SSA, based on the most sensitive exposed population PPLV (i.e., the industrial worker), are:

- Aldrin
- Carbon tetrachloride

- Chlordane
- Dibromochloropropane
- Dieldrin
- 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene (PPDDE)
- 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane (PPDDT)
- Hexachlorocyclopentadiene
- Isodrin
- Methylene chloride
- 1,1,2,2-Tetrachloroethane
- Arsenic
- Chromium
- Lead.

No contaminants of significance (COSs) in groundwater (i.e., those displaying vapor exposure indices (VEI) greater than 1) were identified for the SSA.

1.0 INTRODUCTION

The analyses and evaluations performed under the Rocky Mountain Arsenal (RMA) Exposure Assessment are documented in eight report volumes. These include Volume I, Surface Use and Exposed Population Evaluations; Volumes II and III, Toxicity Assessment; Volumes IV and V, Preliminary Pollutant Limit Value (PPLV) Methodology; Volume VI, Study Area Exposure Assessments; Volume VII, Summary Exposure Assessment; and Volume VIII, Response to Comments on the Draft Exposure Assessment.

Volume VI of the Exposure Assessment is a detailed presentation of the study area exposure analyses, consisting of site-by-site comparisons of measured maximum contaminant concentrations to their Draft PPLVs derived for an industrial worker (the most sensitive receptor). Volume VI consists of eight subvolumes, VI-A through VI-H. Subvolume C (this document) constitutes the Study Area Exposure Assessment for the Southern Study Area (SSA). The remaining subvolumes are: VI-A, Introduction; VI-B, Western Study Area; VI-D, North Central Study Area; VI-E, Central Study Area; VI-F, Eastern Study Area; VI-G, South Plants Study Area; and VI-H, North Plants Study Area. A description of the contents, approach, specific procedures, and format in preparing the Study Area Exposure Assessment documents is presented in Volume VI-A.

The exposure assessment for the SSA was performed on a site-by-site basis. The site designations are consistent with those used in the remedial investigation (RI) Study Area Report (SAR) for the SSA (EBASCO, 1989a). The analytical data used for each site were based on the original Rocky Mountain Arsenal Contamination Control Program Management Team (RMACCPMT)/Phase I and II RI site Contamination Assessment Reports (CARs). Additional information on the history of these sites can be found in Section 3.2 of the SAR (EBASCO, 1989a). The SARs present a regional overview of the extent of contamination and migration characteristics throughout the Arsenal. An analogous regional overview of the exposure assessment for the SSA is presented in the Study Area Exposure Summary, Section 3.0 of this report volume. This regional summary is integrated with the other study area exposure summaries in Volume VII to provide an Arsenal-wide perspective of the significance of the measured contamination.

The sites included in the SSA Exposure Assessment are as follows:

- SSA-1a: Eastern Upper Derby Lake
- SSA-1b: Upper Derby Lake
- SSA-1c: Lower Derby Lake
- SSA-1d: Rod and Gun Club Pond
- SSA-1e: Lake Ladora
- SSA-1f: Lake Mary
- SSA-2a: Drainage Ditches
- SSA-2b: Sand Creek Lateral
- SSA2-c: Drainage Ditch and Overflow Basin
- SSA-3a: Buried Lake Sludge
- SSA-3b: Buried Lake Sludge
- SSA-4: Trash Dump
- SSA-5a: Section 1 - Dibromochloropropane Detection
- SSA-5b: Havana/Peoria Streets - Ponds and Ditches
- SSA-5c: Section 12 - Lead Detection
- SSA-5d: Section 12 Lead Detection
- SSA-5e: Section 11 - Ulvalda Ditch

The locations of each of the sites listed above in the SSA were depicted in the Southern SAR (EBASCO, 1989a). The site-by-site exposure assessments for each of the 17 areas investigated are presented in Sections 2.1 through 2.17. A study area exposure summary for the SSA is presented in Section 3.0.

The Soil Contaminant Concentration Tables in Sections 2.1 through 2.17, list the maximum concentrations that were calculated for each site over two depth intervals, designated as Horizon 1 and Horizon 2. Horizon 1 included depths from 0 to 10 feet (ft), and Horizon 2 accounted for all depths, including 0 to 10 ft. If the maximum concentration for all depths is in Horizon 1, then the listed concentration in Horizon 2 will equal Horizon 1. For a further discussion, see Volume VI-A, Section 2.2.4. The Inductively

Coupled Plasma (ICP) metals (i.e., cadmium, chromium, copper, lead, and zinc), arsenic, and mercury identified as site contaminants in the tables include only those which were detected above indicator levels. The following are the indicator levels used:

Contaminant	Indicator Level
Arsenic	CRL[1]-10 ug/g[2]
Cadmium	1-2 ug/g
Chromium	25-40 ug/g
Copper	20-35 ug/g
Lead	25-40 ug/g
Mercury	CRL-0.10 ug/g
Zinc	60-80 ug/g

As described in Volume VI-A of this report, nontarget contaminants were subjected to two screening processes to determine whether or not they should be evaluated in detail in the site-by-site exposure assessments. The first screening was conducted as part of the RMA Chemical Index (EBASCO, 1988b/RIC 88357R01), and was based on the toxicity, concentration, and frequency of occurrence of the nontarget compounds. Contaminants passing through this first screening were then subjected to a second screening that was conducted on a study area-by-study area basis within Appendix A of each Study Area Exposure Assessment (Volumes VI-B through VI-H). This second screening process considered frequency of occurrence, similarity of the nontarget concentration to that of target contaminants, and co-occurrence of nontarget compounds with target compounds in the soil and sediment samples. The reader is encouraged to consult the RMA Chemical Index and the Study Area Exposure Assessment Appendices for details of the screening processes, as it was judged too repetitive to include this information in each site where nontargets were detected.

1/ certified reporting limit
2/ micrograms per gram

2.0 SITE-BY-SITE EXPOSURE ASSESSMENT

2.1 SITE SSA-1a: EASTERN UPPER DERBY LAKE (formerly Site 6-2: Eastern Upper Derby Lake, Upper Derby Lake Overflow; EBASCO, 1987a/RIC 87196R03 and EBASCO, 1988a/RIC 87196R03A)

2.1.1 Site-Specific Considerations

Figure SSA-1a-1 and Table SSA-1a-1 depict the target contaminants for Site SSA-1a. Borings 2 through 16 were included in this exposure assessment, consistent with the Southern SAR. According to the site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-1a (EBASCO, 1987a/RIC 87196R03).

2.1.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-1a are shown in Figure SSA-1a-1. 1,1,2,2-Tetrachloroethane, occurring in Boring 7 (0-1 ft) was not included in the figure since it was not considered a target contaminant during Phase I and Phase II investigations. Although not shown on this figure, this nontarget compound was included in the Southern SAR and in this exposure assessment because it passed through the screening process performed in the RMA Chemical Index (EBASCO, 1988b/RIC88357R01).

Table SSA-1a-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and certified reporting limits (CRLs) for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

2.1.3 Site Exposure Summary

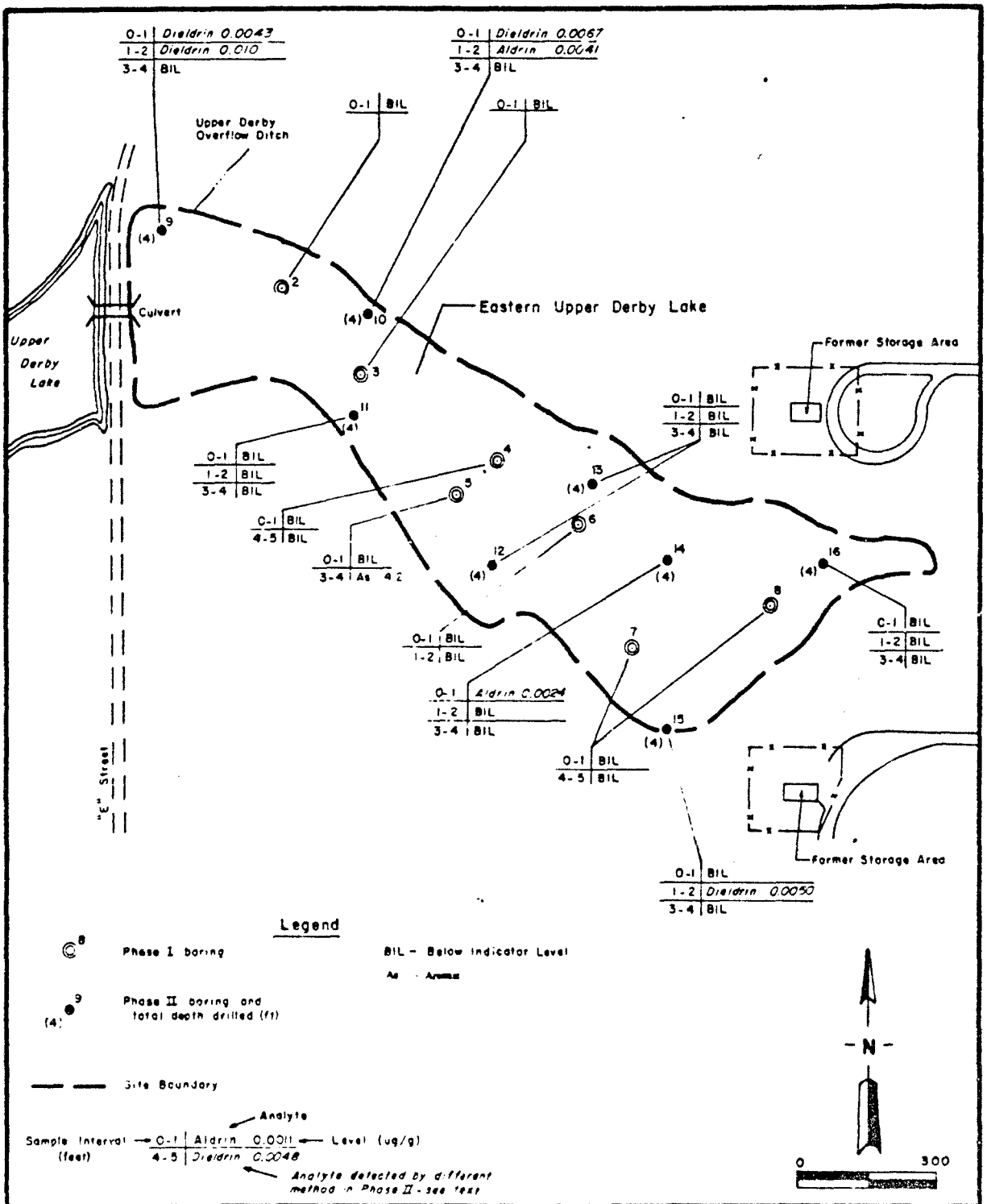
Tables SSA-1a-2 through SSA-1a-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical

exposure pathway identified. Site SSA-1a is considered a lake site, therefore the enclosed space vapor inhalation exposure pathway is not included in the calculation of the cumulative quantity.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
1,1,2,2-Tetra-chloroethane	--	--	--	--	Cumulative

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

It should be noted that for 1,1,2,2-tetrachloroethane the cumulative EI exceeds 0.1 for an industrial worker but the direct and indirect EIs do not exceed 0.1. Site SSA-1a is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Prepared for:

Program Manager's Office for
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Aberdeen Proving Ground, Maryland

FIGURE SSA-1a-1

Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

TABLE SSA-1a-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-1a

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Aldrin	0.0041	1-2	10	0.0041	1-2	10
Dieldrin	0.010	1-2	9	0.010	1-2	9
1,1,2,2-Tetrachloroethane[1/]	0.90	0-1	7	0.90	0-1	7

1/ Nontarget contaminant. Refer to the exposure assessment nontarget screen in Appendix A.

SSA	Southern Study Area
Max.	Maximum
ug/g	microgram per gram
ft	foot/feet

SSA-1a-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	3.8E+04	1.5E+00	2.7E-03	1.1E-07	2.7E-03	0.0E+00
DIELDRIN	1.6E+00	1.8E+04	1.6E+00	6.4E-03	5.7E-07	6.4E-03	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.3E+02	4.1E+02	9.7E+01	7.1E-03	2.2E-03	9.3E-03	0.0E+00

SSA-1a-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPM
ALDRIN	1.5E+00	3.8E+04	1.5E+00	2.7E-03	1.1E-07	2.7E-03	0.0E+00
DIELDRIN	1.6E+00	1.8E+04	1.6E+00	6.4E-03	5.7E-07	6.4E-03	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.3E+02	4.1E+02	9.7E+01	7.1E-03	2.2E-03	9.3E-03	0.0E+00

SSA-1a-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI CPN
ALDRIN	2.1E-01	2.5E+03	2.1E-01	2.0E-02	1.6E-06	2.0E-02	0.0E+00
DIELDRIN	2.2E-01	1.2E+03	2.2E-01	4.6E-02	8.6E-06	4.6E-02	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.8E+01	6.3E+01	1.4E+01	5.1E-02	1.4E-02	6.5E-02	0.0E+00

SSA-1a-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	0.0E+00	1.9E+00	2.2E-03	0.0E+00	2.2E-03	LS
DIELDRIN	2.0E+00	0.0E+00	2.0E+00	5.0E-03	0.0E+00	5.0E-03	LS
1,1,2,2-TETRACHLOROETHANE	1.6E+02	0.0E+00	1.6E+02	5.6E-03	0.0E+00	5.6E-03	LS

SSA-1a-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI EMC
ALDRIN	1.2E-01	5.1E+03	0.0E+00	1.2E-01	3.5E-02	8.0E-07	3.5E-02	0.0E+00	LS
DIELDRIN	1.2E-01	2.3E+03	0.0E+00	1.2E-01	8.2E-02	4.3E-06	8.2E-02	0.0E+00	LS
1,1,2,2-TETRACHLOROETHANE	9.9E+00	5.5E+01	0.0E+00	8.4E+00	9.1E-02	1.7E-02	1.1E-01*	0.0E+00	LS

*: EI is equal to or exceeds 1.0E-01

2.2 SITE SSA-1b: UPPER DERBY LAKE (formerly Site 1-2: Upper and Lower Derby Lakes; EBASCO, 1987b/RIC 87196R02 and EBASCO, 1988c/RIC 87196R02A)

2.2.1 Site-Specific Considerations

Figure SSA-1b-1 and Table SSA-1b-1 depict the target contaminants for Site SSA-1b. Borings 28 through 45 and 64 through 82 were included in this exposure assessment, consistent with the Southern SAR. The historical search conducted under the contaminant assessment revealed that chlorinated hydrocarbons were suspected to be present in Site SSA-1b (EBASCO, 1987b/RIC 87196R02). According to site history, no other chemicals from the RMA target contaminant list were suspected to be present in Site SSA-1b (EBASCO, 1987b/RIC 87196R02).

2.2.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-1b are depicted in Figure SSA-1b-1. 1,1,2,2-Tetrachloroethane occurring in Boring 31 (0-1 ft) was not included in the figure since it was not considered a target contaminant during Phase I and Phase II investigations. Although not shown in this figure, this nontarget compound was included in the Southern SAR on this exposure assessment because it passed through the screening process performed on the RMA Chemical Index (EBASCO 1988b/RIC 88357R01).

Table SSA-1b-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

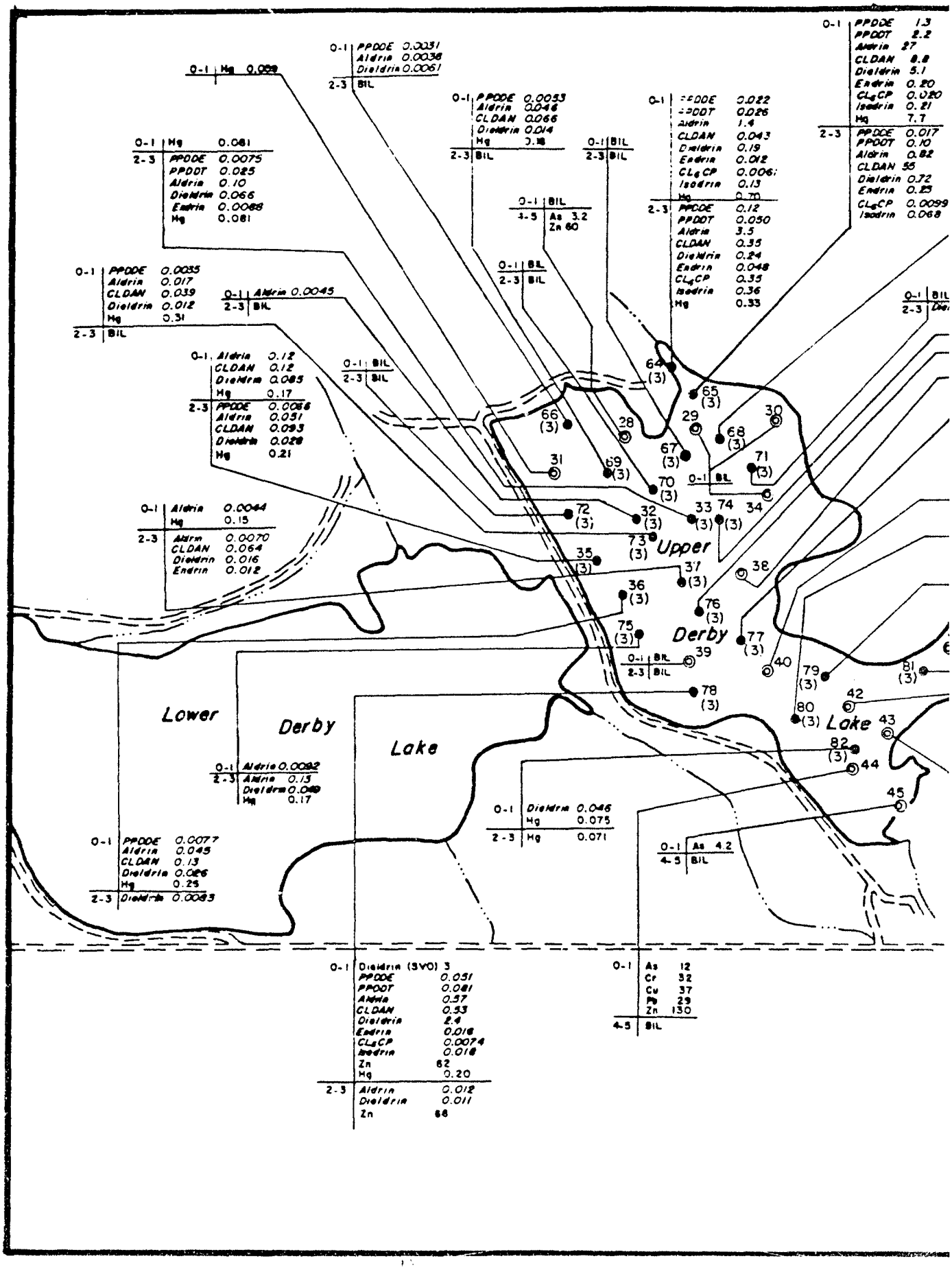
2.2.3 Site Exposure Summary

Tables SSA-1b-2 through SSA-1b-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified. Site SSA-1b is considered a lake site, therefore the enclosed space vapor inhalation exposure pathway is not included in the calculation of the cumulative quantity.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Aldrin	Direct	Direct	Direct	Dir/Ind	Dir/Ind
Chlordane	Direct	Direct	Direct	Direct	Dir/Ind
Arsenic	Direct	Direct	Direct	Direct	Direct
PPDDE	--	--	Direct	--	Direct
PPDDT	--	--	Direct	Indirect	Dir/Ind
Dieldrin	Direct	Direct	Direct	Direct	Dir/Ind
1,1,2,2-Tetra-chloroethane	--	--	--	--	Direct

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

The results of the soil exposure summary indicate that exposure to contamination from the direct and indirect pathways both contribute to the exceedance of the cumulative PPLVs. Site SSA-1b is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).


Upper
Derby
Lake
Lower
Derby
Lake
0-1 Hg 0.098
0-1 PPDDE 0.0031
Aldrin 0.0036
Dieldrin 0.0061
2-3 BIL
0-1 PPDDE 0.0033
Aldrin 0.044
CLDAN 0.066
Dieldrin 0.014
Hg 0.18
2-3 BIL
0-1 BIL
2-3 BIL
0-1 PPDDE 0.022
PPDDT 0.026
Aldrin 1.4
CLDAN 0.043
Dieldrin 0.19
Endrin 0.012
CL6CP 0.006
Isodrin 0.13
Hg 0.70
2-3 PPDDE 0.12
PPDDT 0.050
Aldrin 3.5
CLDAN 0.35
Dieldrin 0.24
Endrin 0.048
CL4CP 0.35
Isodrin 0.36
Hg 0.33
0-1 PPDDE 1.3
PPDDT 2.2
Aldrin 27
CLDAN 8.8
Dieldrin 5.1
Endrin 0.20
CL6CP 0.020
Isodrin 0.21
Hg 7.7
2-3 PPDDE 0.017
PPDDT 0.10
Aldrin 0.82
CLDAN 55
Dieldrin 0.72
Endrin 0.25
CL6CP 0.0099
Isodrin 0.068
0-1 Hg 0.081
2-3 PPDDE 0.0075
PPDDT 0.025
Aldrin 0.10
Dieldrin 0.066
Endrin 0.0068
Hg 0.081
0-1 BIL
4-5 As 3.2
Zn 60
0-1 PPDDE 0.0035
Aldrin 0.017
CLDAN 0.039
Dieldrin 0.012
Hg 0.31
2-3 BIL
0-1 Aldrin 0.0045
2-3 BIL
0-1 BIL
2-3 BIL
0-1 Aldrin 0.12
CLDAN 0.12
Dieldrin 0.085
Hg 0.17
2-3 PPDDE 0.0086
Aldrin 0.031
CLDAN 0.093
Dieldrin 0.028
Hg 0.21
0-1 BIL
2-3 BIL
0-1 Aldrin 0.0044
Hg 0.15
2-3 Aldrin 0.0070
CLDAN 0.064
Dieldrin 0.016
Endrin 0.012
0-1 BIL
2-3 BIL
0-1 BIL
4-5 BIL
0-1 Aldrin 0.0092
2-3 Aldrin 0.13
Dieldrin 0.060
Hg 0.17
0-1 PPDDE 0.0077
Aldrin 0.045
CLDAN 0.13
Dieldrin 0.026
Hg 0.25
2-3 Dieldrin 0.0093
0-1 Dieldrin 0.046
Hg 0.075
2-3 Hg 0.071
0-1 As 4.2
4-5 BIL
0-1 Dieldrin (SVO) 3
PPDDE 0.051
PPDDT 0.081
Aldrin 0.57
CLDAN 0.53
Dieldrin 2.4
Endrin 0.016
CL6CP 0.0074
Isodrin 0.018
Zn 62
Hg 0.20
2-3 Aldrin 0.012
Dieldrin 0.011
Zn 66
0-1 As 12
Cr 32
Cu 37
Pb 29
Zn 130
4-5 BIL
64 (3)
65 (3)
66 (3)
28
29
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67 (3)
68 (3)
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69 (3)
70 (3)
71 (3)
72 (3)
32 (3)
33 (3)
74 (3)
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73 (3)
35 (3)
37 (3)
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36 (3)
76 (3)
75 (3)
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81 (3)
78 (3)
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80 (3)
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82 (3)
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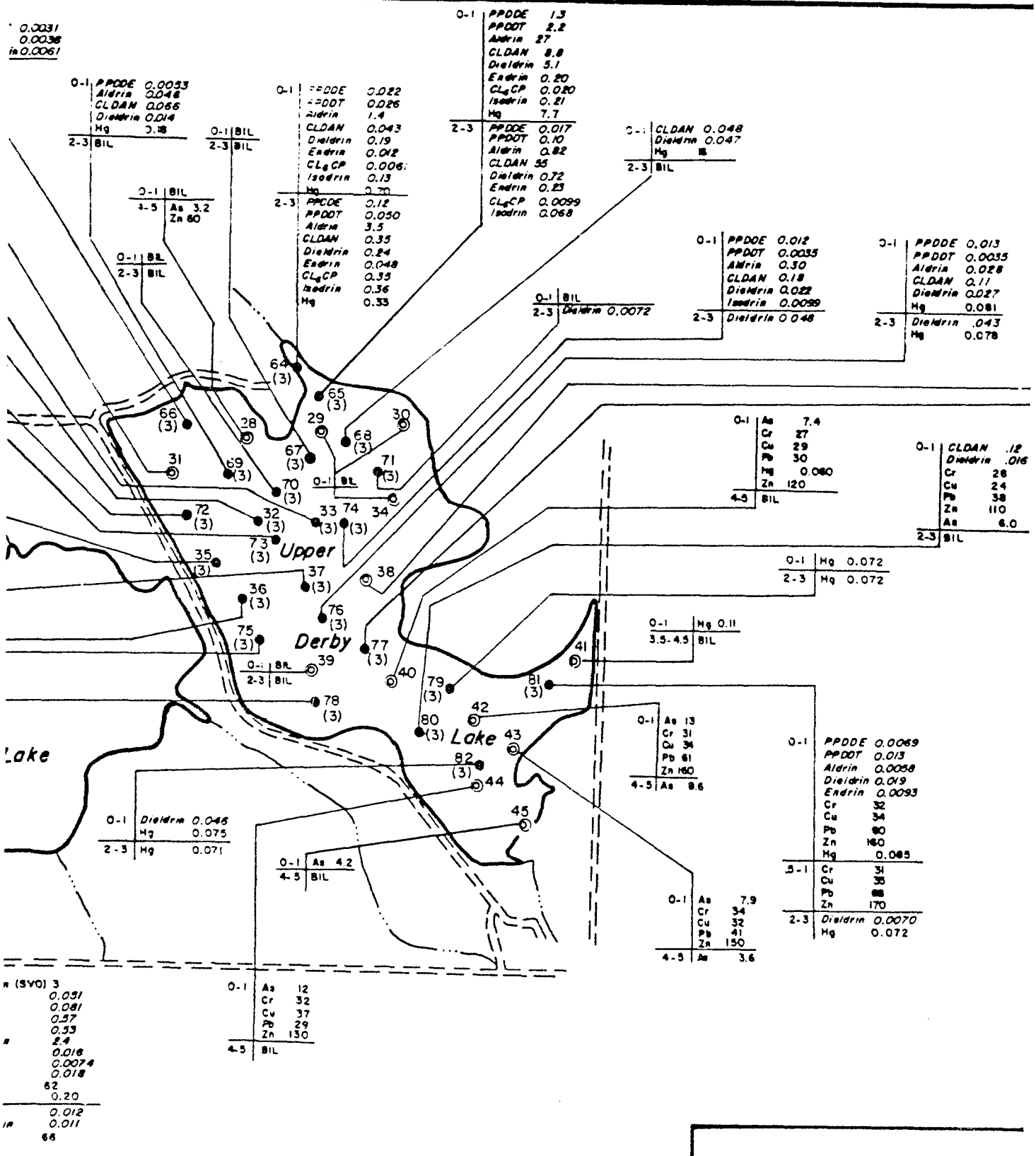
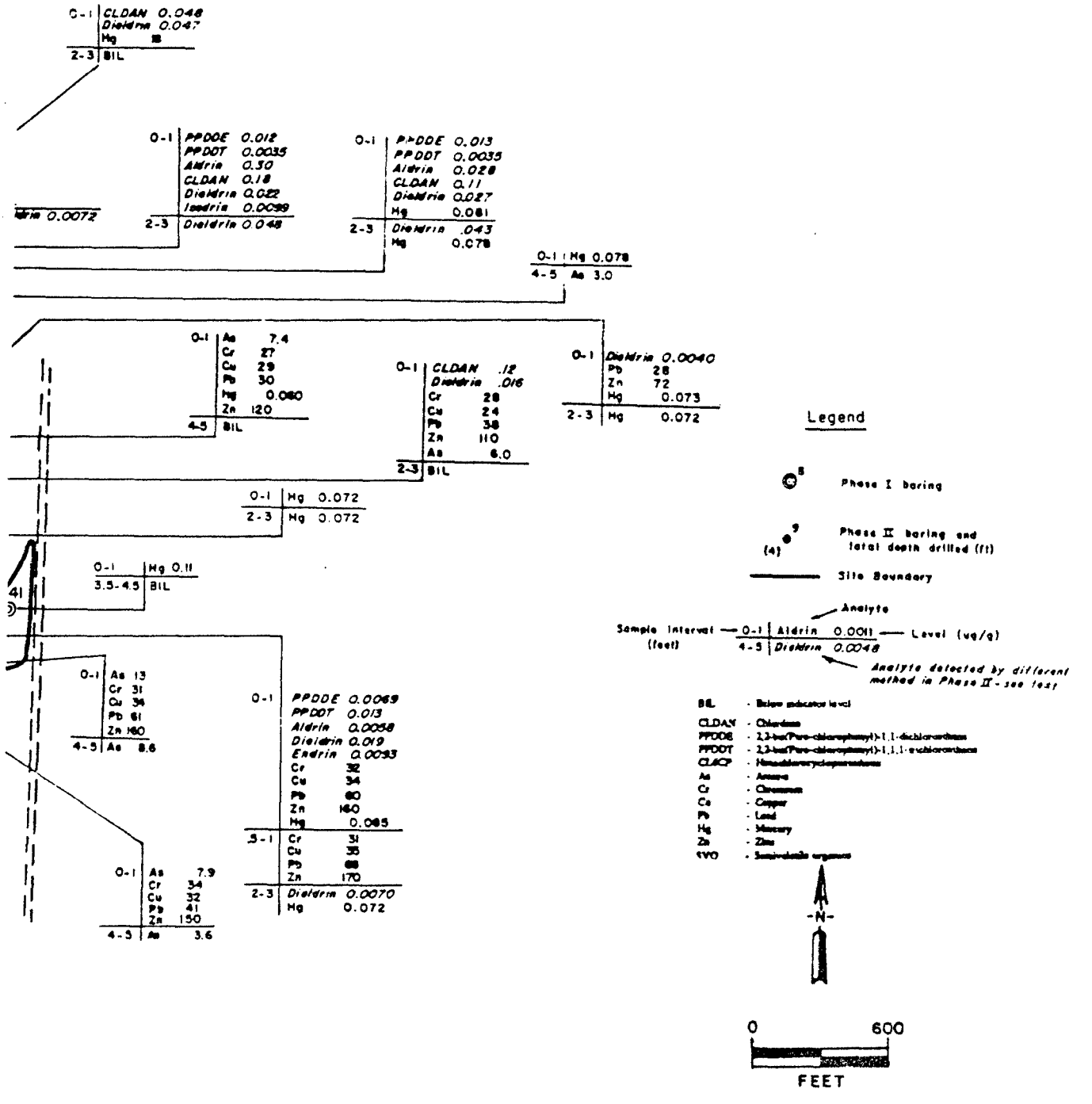


Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground; Maryl



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Clean-up
Aberdeen Proving Ground; Maryland

FIGURE SSA-1b-1

Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

TABLE SSA-1b-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-1b

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Aldrin	27	0-1	65	27	0-1	65
Chlordane	55	2-3	65	55	2-3	65
Dieldrin	5.1	0-1	65	5.1	0-1	65
PPDDE[1/]	1.3	0-1	65	1.3	0-1	65
PPDDT[2/]	2.2	0-1	65	2.2	0-1	65
Endrin	0.23	2-3	65	0.23	2-3	65
Hexachlorocyclopentadiene	0.35	2-3	64	0.35	2-3	64
Isodrin	0.36	2-3	64	0.36	2-3	64
1,1,2,2-Tetrachloroethane[3/]	1.0	0-1	31	1.0	0-1	31
Arsenic	13	0-1	42	--	--	--
Copper	37	0-1	44	--	--	--
Lead	68	0.5-1	81	--	--	--
Mercury	18	0-1	68	--	--	--
Zinc	170	0.5-1	81	--	--	--

1/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
2/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane
3/ Nontarget contaminant. Refer to the exposure assessment nontarget screen in Appendix A.

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-1b-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	1.5E+06	1.5E+00	1.8E+01*	1.8E-05	1.8E+01*	0.0E+00
CHLORDANE	2.0E+01	1.6E+08	2.0E+01	2.8E+00*	3.4E-07	2.8E+00*	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	3.2E+00*	7.5E-06a	3.2E+00*	0.0E+00
PPDDE	7.4E+01	8.9E+07	7.4E+01	1.8E-02	1.5E-08	1.8E-02	0.0E+00
PPDDT	7.4E+01	1.9E+08	7.4E+01	3.0E-02	1.2E-08	3.0E-02	0.0E+00
ENDRIN	2.5E+03	5.5E+08	2.5E+03	9.3E-05	4.2E-10	9.3E-05	0.0E+00
HEXACHLOROCYCLOPENTADIENE	1.7E+04	1.9E+04	8.8E+03	2.1E-05	1.9E-05	4.0E-05	0.0E+00
ISODRIN	5.8E+02	1.1E+08	5.8E+02	6.2E-04	3.4E-09	6.2E-04	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.3E+02	1.1E+04	1.3E+02	7.9E-03	9.2E-05	8.0E-03	0.0E+00
ARSENIC	2.2E+01	0.0E+00	2.2E+01	6.0E-01*	0.0E+00	6.0E-01*	0.0E+00
COPPER	4.2E+05	0.0E+00	4.2E+05	8.9E-05	0.0E+00	8.9E-05	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	4.4E-03	0.0E+00	4.4E-03	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	5.4E-03	0.0E+00	5.4E-03	0.0E+00
ZINC	2.0E+06	0.0E+00	2.0E+06	8.6E-05	0.0E+00	8.6E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1b-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	1.5E+06	1.5E+00	1.8E+01*	1.8E-05	1.8E+01*	0.0E+00
CHLORDANE	2.0E+01	1.6E+08	2.0E+01	2.8E+00*	3.4E-07	2.8E+00*	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	3.2E+00*	7.5E-06a	3.2E+00*	0.0E+00
PPDDE	7.4E+01	8.9E+07	7.4E+01	1.8E-02	1.5E-08	1.8E-02	0.0E+00
PPDDT	7.4E+01	1.9E+08	7.4E+01	3.0E-02	1.2E-08	3.0E-02	0.0E+00
ENDRIN	2.5E+03	5.5E+08	2.5E+03	9.3E-05	4.2E-10	9.3E-05	0.0E+00
HEXACHLOROCYCLOPENTADIENE	1.7E+04	1.9E+04	8.8E+03	2.1E-05	1.9E-05	4.0E-05	0.0E+00
ISODRIN	5.8E+02	1.1E+08	5.8E+02	6.2E-04	3.4E-09	6.2E-04	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.3E+02	1.1E+04	1.3E+02	7.9E-03	9.2E-05	8.0E-03	0.0E+00
ARSENIC	2.2E+01	0.0E+00	2.2E+01	6.0E-01*	0.0E+00	6.0E-01*	0.0E+00
COPPER	4.2E+05	0.0E+00	4.2E+05	8.9E-05	0.0E+00	8.9E-05	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	4.4E-03	0.0E+00	4.4E-03	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	5.4E-03	0.0E+00	5.4E-03	0.0E+00
ZINC	2.0E+06	0.0E+00	2.0E+06	8.6E-05	0.0E+00	8.6E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1b-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	9.8E+04	2.1E-01	1.3E+02*	2.6E-04	1.3E+02*	0.0E+00
CHLORDANE	2.7E+00	1.1E+07	2.7E+00	2.0E+01*	5.2E-06	2.0E+01*	0.0E+00
DIELDRIN	2.2E-01	1.0E+06	2.2E-01	2.3E+01*	1.1E-04a	2.3E+01*	0.0E+00
PPDDE	1.0E+01	5.9E+06	1.0E+01	1.3E-01*	2.2E-07	1.3E-01*	0.0E+00
PPDDT	1.0E+01	1.3E+07	1.0E+01	2.2E-01*	1.8E-07	2.2E-01*	0.0E+00
ENDRIN	1.1E+03	8.5E+07	1.1E+03	2.2E-04	2.7E-09	2.2E-04	0.0E+00
HEXACHLOROCYCLOPENTADIENE	5.7E+03	6.7E+03	3.1E+03	6.2E-05	5.2E-05	1.1E-04	0.0E+00
ISODRIN	2.5E+02	1.7E+07	2.5E+02	1.5E-03	2.2E-08	1.5E-03	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.8E+01	1.7E+03	1.7E+01	5.7E-02	6.0E-04	5.7E-02	0.0E+00
ARSENIC	3.9E+00	0.0E+00	3.9E+00	3.3E+00*	0.0E+00	3.3E+00*	0.0E+00
COPPER	2.5E+05	0.0E+00	2.5E+05	1.5E-04	0.0E+00	1.5E-04	0.0E+00
LEAD	9.2E+03	0.0E+00	9.2E+03	7.4E-03	0.0E+00	7.4E-03	0.0E+00
MERCURY	2.0E+03	0.0E+00	2.0E+03	9.1E-03	0.0E+00	9.1E-03	0.0E+00
ZINC	1.1E+06	0.0E+00	1.1E+06	1.6E-04	0.0E+00	1.6E-04	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1b-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	4.0E-01	3.3E-01	1.4E+01*	6.8E+01*	8.2E+01*	LS
CHLORDANE	2.5E+01	1.4E+04	2.5E+01	2.2E+00*	4.0E-03	2.2E+00*	LS
DIELDRIN	2.0E+00	1.0E+06	1.9E+00	2.6E+00*	8.9E-02a	2.7E+00*	LS
PPDDE	9.3E+01	1.9E+01	1.6E+01	1.4E-02	6.7E-02	8.1E-02	LS
PPDDT	9.3E+01	1.9E+01	1.6E+01	2.4E-02	1.1E-01*	1.4E-01*	LS
ENDRIN	1.4E+03	2.9E+02	2.4E+02	1.7E-04	8.0E-04	9.7E-04	LS
HEXACHLOROCYCLOPENTADIENE	5.5E+03	1.9E+01	1.9E+01	6.4E-05	1.8E-02	1.8E-02	LS
ISODRIN	3.2E+02	6.7E+01	5.5E+01	1.1E-03	5.4E-03	6.5E-03	LS
1,1,2,2-TETRACHLOROETHANE	1.6E+02	3.4E+01	2.8E+01	6.2E-03	3.0E-02	3.6E-02	LS
ARSENIC	2.0E+01	0.0E+00	2.0E+01	6.5E-01*	0.0E+00	6.5E-01*	LS
COPPER	1.8E+05	0.0E+00	1.8E+05	2.1E-04	0.0E+00	2.1E-04	LS
LEAD	6.5E+03	0.0E+00	6.5E+03	1.0E-02	0.0E+00	1.0E-02	LS
MERCURY	1.4E+03	0.0E+00	1.4E+03	1.3E-02	0.0E+00	1.3E-02	LS
ZINC	7.8E+05	0.0E+00	7.8E+05	2.2E-04	0.0E+00	2.2E-04	LS

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

SSA-1b-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	2.0E+05	4.0E-01	9.0E-02	2.3E+02*	6.8E+01*	3.0E+02*	0.0E+00	LS
CHLORDANE	1.5E+00	2.1E+07	5.2E+00	1.2E+00	3.6E+01*	1.1E+01*	4.7E+01*	0.0E+00	LS
DIELDRIN	1.2E-01	9.0E+04	1.9E+01	1.2E-01	4.2E+01*	2.7E-01*	4.2E+01*	0.0E+00	LS
PPDDE	5.7E+00	1.2E+07	1.9E+01	4.4E+00	2.3E-01*	6.7E-02	2.9E-01*	0.0E+00	LS
PPDDT	5.7E+00	2.5E+07	1.9E+01	4.4E+00	3.8E-01*	1.1E-01*	5.0E-01*	0.0E+00	LS
ENDRIN	2.5E+02	7.3E+07	8.6E+02	2.0E+02	9.1E-04	2.7E-04	1.2E-03	0.0E+00	LS
HEXACHLOROCYCLOPENTADIENE	3.8E+02	2.5E+03	5.8E+01	4.9E+01	9.1E-04	6.2E-03	7.1E-03	0.0E+00	LS
ISODRIN	5.9E+01	1.4E+07	2.0E+02	4.6E+01	6.1E-03	1.8E-03	7.9E-03	0.0E+00	LS
1,1,2,2-TETRACHLOROETHANE	9.9E+00	1.4E+03	3.4E+01	7.6E+00	1.0E-01*	3.0E-02	1.3E-01*	0.0E+00	LS
ARSENIC	1.6E+00	0.0E+00	0.0E+00	1.6E+00	8.1E+00*	0.0E+00	8.1E+00*	0.0E+00	LS
COPPER	5.7E+04	0.0E+00	0.0E+00	5.7E+04	6.5E-04	0.0E+00	6.5E-04	0.0E+00	LS
LEAD	2.2E+03	0.0E+00	0.0E+00	2.2E+03	3.1E-02	0.0E+00	3.1E-02	0.0E+00	LS
MERCURY	4.6E+02	0.0E+00	0.0E+00	4.6E+02	3.9E-02	0.0E+00	3.9E-02	0.0E+00	LS
ZINC	1.4E+05	0.0E+00	0.0E+00	1.4E+05	1.2E-03	0.0E+00	1.2E-03	0.0E+00	LS

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.3 SITE SSA-1c: LOWER DERBY LAKE (formerly Site 1-2: Upper and Lower Derby Lakes; EBASCO, 1987b/RIC 87196R02 and EBASCO, 1988c/RIC 87196R02A)

2.3.1 Site-Specific Considerations

Figure SSA-1c-1 and Table SSA-1c-1 depict the target contaminants for Site SSA-1c. Borings 1 through 17, 19 through 27, and 46 through 63 were included in this exposure assessment, consistent with the Southern SAR. The historical search conducted under the contaminant assessment revealed that chlorinated hydrocarbons were suspected to be present in Site SSA-1c (EBASCO, 1987b/RIC 87196R02). According to site history, no other chemicals from the RMA target contaminant list were suspected to be present in Site SSA-1c (EBASCO, 1988c/RIC 87196R02A).

2.3.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-1c are depicted in Figure SSA-1c-1. Table SSA-1c-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

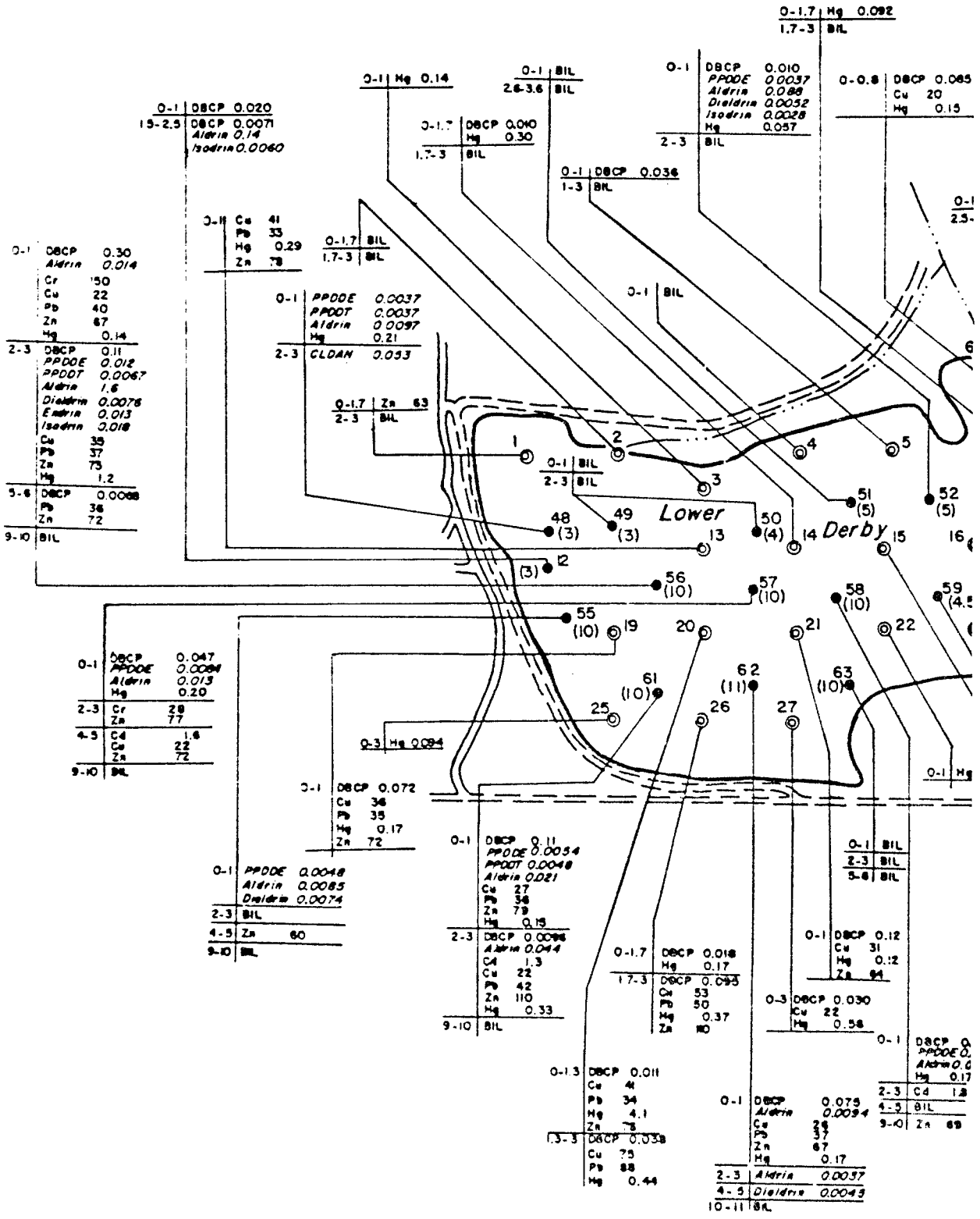
2.3.3 Site Exposure Summary

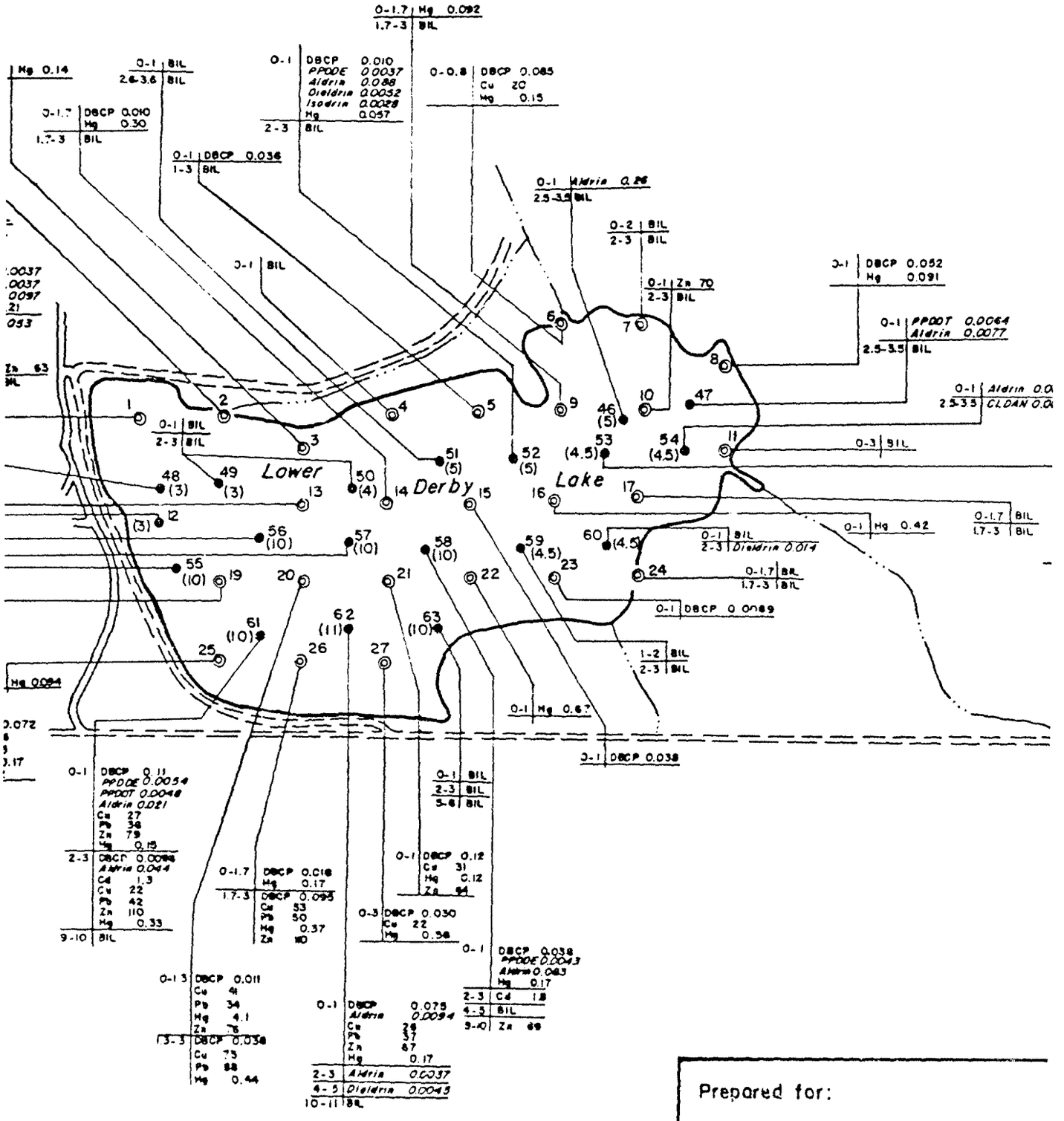
Tables SSA-1c-2 through SSA-1c-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified. Site SSA-1c is considered a lake site, therefore the enclosed space vapor inhalation exposure pathway is not included in the calculation of the cumulative quantity.

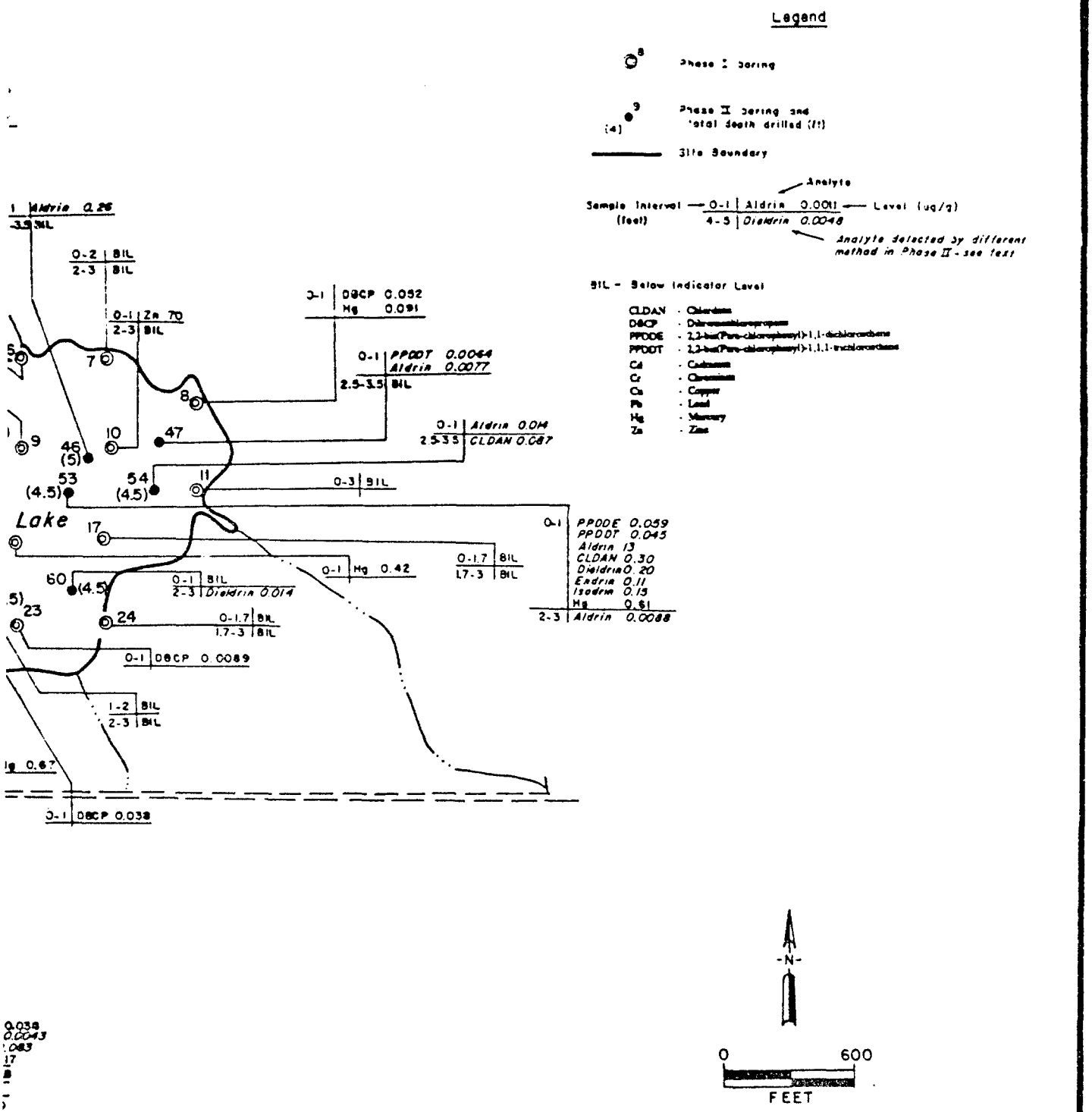
Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Aldrin	Direct	Direct	Direct	Dir/Ind	Dir/Ind
Dieldrin	Direct	Direct	Direct	Direct	Direct
Chromium	Direct	Direct	Direct	Direct	Direct
Chlordane	--	--	Direct	--	Direct
Dibromochloropropane	--	--	Direct	--	Direct

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

The results of the soil exposure summary indicate that exposure to contamination from the direct and indirect pathways both contribute to the exceedance of the cumulative PPLVs. Site SSA-1c is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).


Lower Derby
0-1 DBCP 0.30
Aldrin 0.014
Cr 150
Cu 22
Pb 40
Zn 67
Hg 0.14
2-3 DBCP 0.11
PPDOE 0.012
PPDOT 0.0067
Aldrin 1.6
Dieldrin 0.0078
Endrin 0.013
Isodrin 0.018
Cu 35
Pb 37
Zn 73
Hg 1.2
9-10 BIL
0-1 DBCP 0.020
1.5-2.5 DBCP 0.0071
Aldrin 0.14
Isodrin 0.0060
0-1 Hg 0.14
0-1 BIL
2.6-3.6 BIL
0-1.7 DBCP 0.010
Hg 0.30
1.7-3 BIL
0-1 DBCP 0.036
1-3 BIL
0-1 DBCP 0.010
PPDOE 0.0037
Aldrin 0.088
Dieldrin 0.0052
Isodrin 0.0028
Hg 0.057
2-3 BIL
0-1.7 Hg 0.092
1.7-3 BIL
0-0.8 DBCP 0.085
Cu 20
Hg 0.15
0-1 Cu 41
Pb 33
Hg 0.29
Zn 78
0-1.7 BIL
1.7-3 BIL
0-1 PPDOE 0.0037
PPDOT 0.0037
Aldrin 0.0097
Hg 0.21
2-3 CLDAN 0.053
0-1.7 Zn 63
2-3 BIL
0-1 BIL
2-3 BIL
0-1 BIL
0-1 DBCP 0.047
PPDOE 0.0084
Aldrin 0.013
Hg 0.20
2-3 Cr 28
Zn 77
4-5 Cd 1.6
Cu 22
Zn 72
9-10 BIL
0-3 Hg 0.094
0-1 DBCP 0.072
Cu 36
Pb 35
Hg 0.17
Zn 72
0-1 PPDOE 0.0048
Aldrin 0.0085
Dieldrin 0.0074
2-3 BIL
4-5 Zn 60
9-10 BIL
0-1 DBCP 0.11
PPDOE 0.0054
PPDOT 0.0048
Aldrin 0.021
Cu 27
Pb 36
Zn 79
Hg 0.15
2-3 DBCP 0.0096
Aldrin 0.044
Cd 1.3
Cu 22
Pb 42
Zn 110
Hg 0.33
9-10 BIL
0-1.7 DBCP 0.018
Hg 0.17
1.7-3 DBCP 0.095
Cd 53
Pb 50
Hg 0.37
Zn 110
0-1.3 DBCP 0.011
Cu 44
Pb 34
Hg 4.1
Zn 78
1.3-3 DBCP 0.038
Cu 75
Pb 88
Hg 0.44
0-1 DBCP 0.075
Aldrin 0.0094
Cu 28
Pb 37
Zn 67
Hg 0.17
2-3 Aldrin 0.0037
4-5 Dieldrin 0.0043
10-11 BIL
0-1 BIL
2-3 BIL
5-6 BIL
0-1 DBCP 0.12
Cu 31
Hg 0.12
Zn 84
0-3 DBCP 0.030
Cu 22
Hg 0.56
0-1 DBCP 0.
PPDOE 0.
Aldrin 0.0
Hg 0.17
2-3 Cd 1.8
4-5 BIL
9-10 Zn 69
1 2 3 4 5 6
48 (3) 49 (3) 50 (4) 51 (5) 52 (5)
13 14 15 16
12 (3)
56 (10) 57 (10) 58 (10) 59
55 (10) 19 20 21 22
61 (10) 62 (11) 63 (10)
25 26 27


Lower
Derby
Lake
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground; Maryland



Prepared for:	FIGURE SSA-1c-1
Program Manager's Office for Rocky Mountain Arsenal Cleanup Aberdeen Proving Ground; Maryland	Phase I and Phase II Analytes Detected Within or Above Indicator Levels Rocky Mountain Arsenal Prepared by: Ebasco Services Incorporated

TABLE SSA-1c-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-1c

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Aldrin	13	0-1	53	13	0-1	53
Chlordane	0.30	0-1	53	0.30	0-1	53
Dieldrin	0.20	0-1	53	0.20	0-1	53
Dibromochloropropane	0.30	0-1	56	0.30	0-1	56
PPDDE[1/]	0.059	0-1	53	0.059	0-1	53
PPDDT[2/]	0.045	0-1	53	0.045	0-1	53
Endrin	0.11	0-1	53	0.11	0-1	53
Isodrin	0.15	0-1	53	0.15	0-1	53
Chromium	150	0-1	56	--	--	--
Copper	75	1.3-3	20	--	--	--
Lead	88	1.3-3	20	--	--	--
Mercury	4.1	0-1.3	20	--	--	--
Zinc	110	1.7-3	26	--	--	--
		2-3	61	--	--	--

1/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
2/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-1c-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	5.5E+06	1.5E+00	8.7E+00*	2.4E-06	8.7E+00*	0.0E+00
CHLORDANE	2.0E+01	5.9E+08	2.0E+01	1.5E-02	5.1E-10	1.5E-02	0.0E+00
DIBROMOCHLOROPROPANE	1.8E+01	5.7E+03	1.8E+01	1.7E-02	5.3E-05	1.7E-02	0.0E+00
PPDDE	7.4E+01	3.3E+08	7.4E+01	8.0E-04	1.8E-10	8.0E-04	0.0E+00
PPDDT	7.4E+01	7.0E+08	7.4E+01	6.1E-04	6.4E-11	6.1E-04	0.0E+00
DIELDRIN	1.6E+00	2.5E+06	1.6E+00	1.3E-01*	8.0E-08	1.3E-01*	0.0E+00
ENDRIN	2.5E+03	2.0E+09	2.5E+03	4.4E-05	5.4E-11	4.4E-05	0.0E+00
ISODRIN	5.8E+02	4.0E+08	5.8E+02	2.6E-04	3.8E-10	2.6E-04	0.0E+00
CHROMIUM	6.9E+01	0.0E+00	6.9E+01	2.2E+00*	0.0E+00	2.2E+00*	0.0E+00
COPPER	4.2E+05	0.0E+00	4.2E+05	1.8E-04	0.0E+00	1.8E-04	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	5.7E-03	0.0E+00	5.7E-03	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	1.2E-03	0.0E+00	1.2E-03	0.0E+00
ZINC	2.0E+06	0.0E+00	2.0E+06	5.5E-05	0.0E+00	5.5E-05	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1c-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	5.5E+06	1.5E+00	8.7E+00*	2.4E-06	8.7E+00*	0.0E+00
CHLORDANE	2.0E+01	5.9E+08	2.0E+01	1.5E-02	5.1E-10	1.5E-02	0.0E+00
DIBROMOCHLOROPROPANE	1.8E+01	5.7E+03	1.8E+01	1.7E-02	5.3E-05	1.7E-02	0.0E+00
PPDDE	7.4E+01	3.3E+08	7.4E+01	8.0E-04	1.8E-10	8.0E-04	0.0E+00
PPDOT	7.4E+01	7.0E+08	7.4E+01	6.1E-04	6.4E-11	6.1E-04	0.0E+00
DIELDRIN	1.6E+00	2.5E+06	1.6E+00	1.3E-01*	8.0E-08	1.3E-01*	0.0E+00
ENDRIN	2.5E+03	2.0E+09	2.5E+03	4.4E-05	5.4E-11	4.4E-05	0.0E+00
ISODRIN	5.8E+02	4.0E+08	5.8E+02	2.6E-04	3.8E-10	2.6E-04	0.0E+00
CHROMIUM	6.9E+01	0.0E+00	6.9E+01	2.2E+00*	0.0E+00	2.2E+00*	0.0E+00
COPPER	4.2E+05	0.0E+00	4.2E+05	1.8E-04	0.0E+00	1.8E-04	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	5.7E-03	0.0E+00	5.7E-03	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	1.2E-03	0.0E+00	1.2E-03	0.0E+00
ZINC	2.0E+06	0.0E+00	2.0E+06	5.5E-05	0.0E+00	5.5E-05	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1c-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	3.6E+05	2.1E-01	6.3E+01*	3.6E-05	6.3E+01*	0.0E+00
CHLORDANE	2.7E+00	3.9E+07	2.7E+00	1.1E-01*	7.6E-09	1.1E-01*	0.0E+00
DIBROMOCHLOROPROPANE	2.5E+00	8.8E+02	2.5E+00	1.2E-01*	3.4E-04	1.2E-01*	0.0E+00
PPDDE	1.0E+01	2.2E+07	1.0E+01	5.8E-03	2.7E-09	5.8E-03	0.0E+00
PPDDT	1.0E+01	4.6E+07	1.0E+01	4.4E-03	9.7E-10	4.4E-03	0.0E+00
DIELDRIN	2.2E-01	1.7E+05	2.2E-01	9.2E-01*	1.2E-06	9.2E-01*	0.0E+00
ENDRIN	1.1E+03	3.1E+03	1.1E+03	1.0E-04	3.5E-10	1.0E-04	0.0E+00
ISODRIN	2.5E+02	6.1E+07	2.5E+02	6.1E-04	2.4E-09	6.1E-04	0.0E+00
CHROMIUM	8.8E+00	0.0E+00	8.8E+00	1.7E+01*	0.0E+00	1.7E+01*	0.0E+00
COPPER	2.5E+05	0.0E+00	2.5E+05	3.0E-04	0.0E+00	3.0E-04	0.0E+00
LEAD	9.2E+03	0.0E+00	9.2E+03	9.5E-03	0.0E+00	9.5E-03	0.0E+00
MERCURY	2.0E+03	0.0E+00	2.0E+03	2.1E-03	0.0E+00	2.1E-03	0.0E+00
ZINC	1.1E+06	0.0E+00	1.1E+06	1.0E-04	0.0E+00	1.0E-04	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1c-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	4.0E-01	3.3E-01	6.9E+00*	3.3E+01*	4.0E+01*	LS
CHLORDANE	2.5E+01	1.4E+04	2.5E+01	1.2E-02	2.2E-05	1.2E-02	LS
DIBROMOCHLOROPROPANE	2.3E+01	4.8E+00	3.9E+00	1.3E-02	6.3E-02	7.6E-02	LS
PPDDE	9.3E+01	1.9E+01	1.6E+01	6.3E-04	3.0E-03	3.7E-03	LS
PPDDT	9.3E+01	1.9E+01	1.6E+01	4.8E-04	2.3E-03	2.8E-03	LS
DIELDRIN	2.0E+00	5.8E+01	1.9E+00	1.0E-01*	3.5E-03	1.0E-01*	LS
ENDRIN	1.4E+03	2.9E+02	2.4E+02	8.0E-05	3.8E-04	4.6E-04	LS
ISODRIN	3.2E+02	6.7E+01	5.5E+01	4.7E-04	2.2E-03	2.7E-03	LS
CHROMIUM	5.5E+01	0.0E+00	5.5E+01	2.7E+00*	0.0E+00	2.7E+00*	LS
COPPER	1.8E+05	0.0E+00	1.8E+05	4.3E-04	0.0E+00	4.3E-04	LS
LEAD	6.5E+03	0.0E+00	6.5E+03	1.3E-02	0.0E+00	1.3E-02	LS
MERCURY	1.4E+03	0.0E+00	1.4E+03	2.9E-03	0.0E+00	2.9E-03	LS
ZINC	7.8E+05	0.0E+00	7.8E+05	1.4E-04	0.0E+00	1.4E-04	LS

*: EI is equal to or exceeds 1.0E-01

SSA-1c-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	7.3E+05	4.0E-01	9.0E-02	1.1E+02*	3.3E+01*	1.4E+02*	0.0E+00	LS
CHLORDANE	1.5E+00	7.9E+07	5.2E+00	1.2E+00	2.0E-01*	5.8E-02	2.6E-01*	0.0E+00	LS
DIBROMOCHLOROPROPANE	1.4E+00	7.6E+02	4.8E+00	1.1E+00	2.1E-01*	6.3E-02	2.8E-01*	0.0E+00	LS
PPDDE	5.7E+00	4.4E+07	1.9E+01	4.4E+00	1.0E-02	3.0E-03	1.3E-02	0.0E+00	LS
PPDDT	5.7E+00	9.3E+07	1.9E+01	4.4E+00	7.9E-03	2.3E-03	1.0E-02	0.0E+00	LS
DIELDRIN	1.2E-01	3.3E+05	1.9E+01	1.2E-01	1.6E+00*	1.0E-02	1.6E+00*	0.0E+00	LS
ENDRIN	2.5E+02	2.7E+08	8.6E+02	2.0E+02	4.3E-04	1.3E-04	5.6E-04	0.0E+00	LS
ISODRIN	5.9E+01	5.3E+07	2.0E+02	4.6E+01	2.5E-03	7.5E-04	3.3E-03	0.0E+00	LS
CHROMIUM	1.1E+00	0.0E+00	0.0E+00	1.1E+00	1.3E+02*	0.0E+00	1.3E+02*	0.0E+00	LS
COPPER	5.7E+04	0.0E+00	0.0E+00	5.7E+04	1.3E-03	0.0E+00	1.3E-03	0.0E+00	LS
LEAD	2.2E+03	0.0E+00	0.0E+00	2.2E+03	4.0E-02	0.0E+00	4.0E-02	0.0E+00	LS
MERCURY	4.6E+02	0.0E+00	0.0E+00	4.6E+02	8.9E-03	0.0E+00	8.9E-03	0.0E+00	LS
ZINC	1.4E+05	0.0E+00	0.0E+00	1.4E+05	7.9E-04	0.0E+00	7.9E-04	0.0E+00	LS

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.4 SITE SSA-1d: ROD AND GUN CLUB POND (formerly Site 12-2: Rod and Gun Club Pond; EBASCO, 1987c/RIC 87127R04 and EBASCO, 1988d/RIC 87127R04A)

2.4.1 Site-Specific Considerations

Figure SSA-1d-1 and Table SSA-1d-1 depict the target contaminants for Site SSA-1d. Borings 1 through 9 were included in the exposure assessment, consistent with the Southern SAR. According to the site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-1d (EBASCO, 1987c/RIC 87127R04).

2.4.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-1d are shown in Figure SSA-1d-1. 1,1,2,2-Tetrachloroethane, occurring in Boring 4 (0-1 ft) was not included in the figure since it was not considered a target contaminant during Phase I and Phase II investigations. Although not shown on this figure, this nontarget compound was included in the Southern SAR and in this exposure assessment because it passed through the screening process performed in the RMA Chemical Index (EBASCO, 1988b/RIC88357R01).

Table SSA-1d-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

2.4.3 Site Exposure Summary

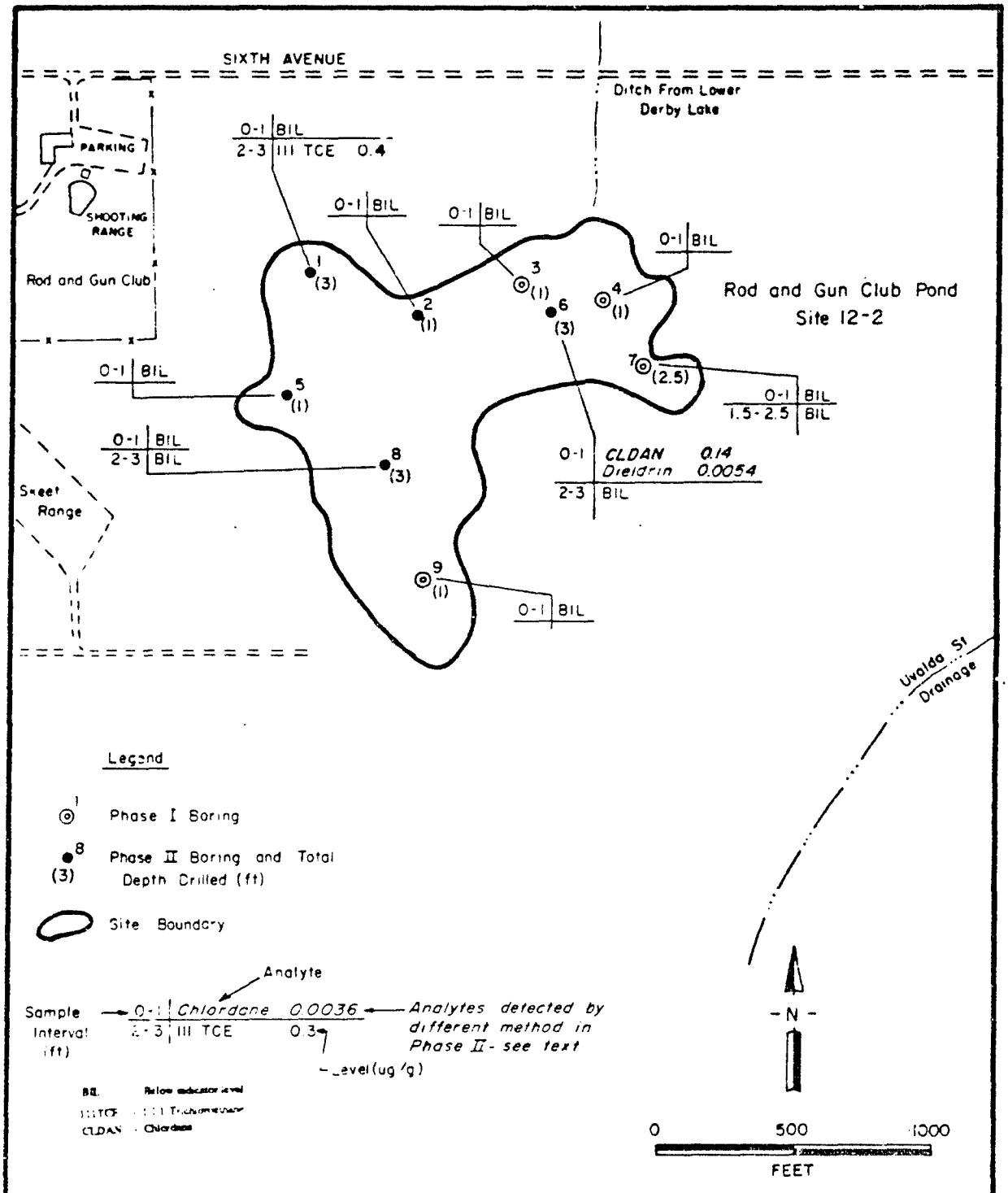
Tables SSA-1d-2 through SSA-1d-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified. Site SSA-1d is considered a lake site, therefore the enclosed

space vapor inhalation exposure pathway is not included in the calculation of the cumulative quantity.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
1,1,2,2-Tetra-chloroethane	--	--	--	--	Cumulative

Note: . Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

It should be noted for 1,1,2,2-tetrachloroethane, the cumulative EI exceeds 0.1 for an industrial worker but the direct and indirect EIs do not exceed 0.1. Site SSA-1d is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-Id-1

Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by Ebasco Services Incorporated

TABLE SSA-1d-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-1d

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Chlordane	0.14	0-1	6	0.14	0-1	6
Dieldrin	0.0054	0-1	6	0.0054	0-1	6
1,1,2,2-Tetrachloroethane[1/]	0.90	0-1	4	0.90	0-1	4
1,1,1-Trichloroethane	0.4	2-3	1	0.4	2-3	1

1/ Nontarget contaminant. Refer to the exposure assessment nontarget screen in Appendix A.

SSA	Southern Study Area
Max.	Maximum
ug/g	microgram per gram
ft	foot/feet

SSA-1d-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
CHLORDANE	2.0E+01	3.4E+06	2.0E+01	7.2E-03	4.2E-08	7.2E-03	0.0E+00
DIELDRIN	1.6E+00	1.4E+04	1.6E+00	3.4E-03	3.8E-07	3.4E-03	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.3E+02	6.7E+02	1.1E+02	7.1E-03	1.3E-03	8.4E-03	0.0E+00
1,1,1-TRICHLOROETHANE	7.5E+05	2.2E+06	5.6E+05	5.4E-07	1.8E-07	7.2E-07	0.0E+00

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1d-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
CHLORDANE	2.0E+01	3.4E+06	2.0E+01	7.2E-03	4.2E-08	7.2E-03	0.0E+00
DIELDRIN	1.6E+00	1.4E+04	1.6E+00	3.4E-03	3.8E-07	3.4E-03	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.3E+02	6.7E+02	1.1E+02	7.1E-03	1.3E-03	8.4E-03	0.0E+00
1,1,1-TRICHLOROETHANE	7.5E+05	2.2E+06	5.6E+05	5.4E-07	1.8E-07	7.2E-07	0.0E+00

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1d-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
CHLORDANE	2.7E+00	2.2E+05	2.7E+00	5.2E-02	6.3E-07	5.2E-02	0.0E+00
DIELDRIN	2.2E-01	9.4E+02	2.2E-01	2.5E-02	5.7E-06	2.5E-02	0.0E+00
1,1,2,2-TETRACHLOROETHANE	1.8E+01	1.0E+02	1.5E+01	5.1E-02	8.6E-03	6.0E-02	0.0E+00
1,1,1-TRICHLOROETHANE	3.2E+05	7.9E+05	2.3E+05	1.3E-06	5.1E-07	1.8E-06	0.0E+00

SSA-1d-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
CHLORDANE	2.5E+01	0.0E+00	2.5E+01	5.7E-03	0.0E+00	5.7E-03	LS
DIELDRIN	2.0E+00	0.0E+00	2.0E+00	2.7E-03	0.0E+00	2.7E-03	LS
1,1,2,2-TETRACHLOROETHANE	1.6E+02	0.0E+00	1.6E+02	5.6E-03	0.0E+00	5.6E-03	LS
1,1,1-TRICHLOROETHANE	4.2E+05	0.0E+00	4.2E+05	9.6E-07	0.0E+00	9.6E-07	LS

SSA-1d-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
CHLORDANE	1.5E+00	4.5E+05	0.0E+00	1.5E+00	9.2E-02	3.1E-07	9.2E-02	0.0E+00	LS
DIELDRIN	1.2E-01	1.9E+03	0.0E+00	1.2E-01	4.4E-02	2.8E-06	4.4E-02	0.0E+00	LS
1,1,2,2-TETRACHLOROETHANE	9.9E+00	9.0E+01	0.0E+00	8.9E+00	9.1E-02	1.0E-02	1.0E-01*	0.0E+00	LS
1,1,1-TRICHLOROETHANE	7.8E+04	2.9E+05	0.0E+00	6.2E+04	5.1E-06	1.4E-06	6.5E-06	0.0E+00	LS

*: EI is equal to or exceeds 1.0E-01

2.5 SITE SSA-1c: LAKE LADORA (formerly Site 2-17: Lake Ladora and Lake Mary; EBASCO, 1987d/RIC 87216R07 and EBASCO, 1988e/RIC 87216R07A)

2.5.1 Site-Specific Considerations

Figure SSA-1e-1 and Table SSA-1e-1 depict the target contaminants for Site SSA-1e. Borings 5 through 21, 24 through 44, 50, and 51 were included in this exposure assessment, consistent with the Southern SAR. According to site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-1e (EBASCO, 1987d/RIC87216R07).

2.5.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-1c are depicted on Figure SSA-1e-1. Table SSA-1e-1 summarizes the maximum concentrations of contaminants measured above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

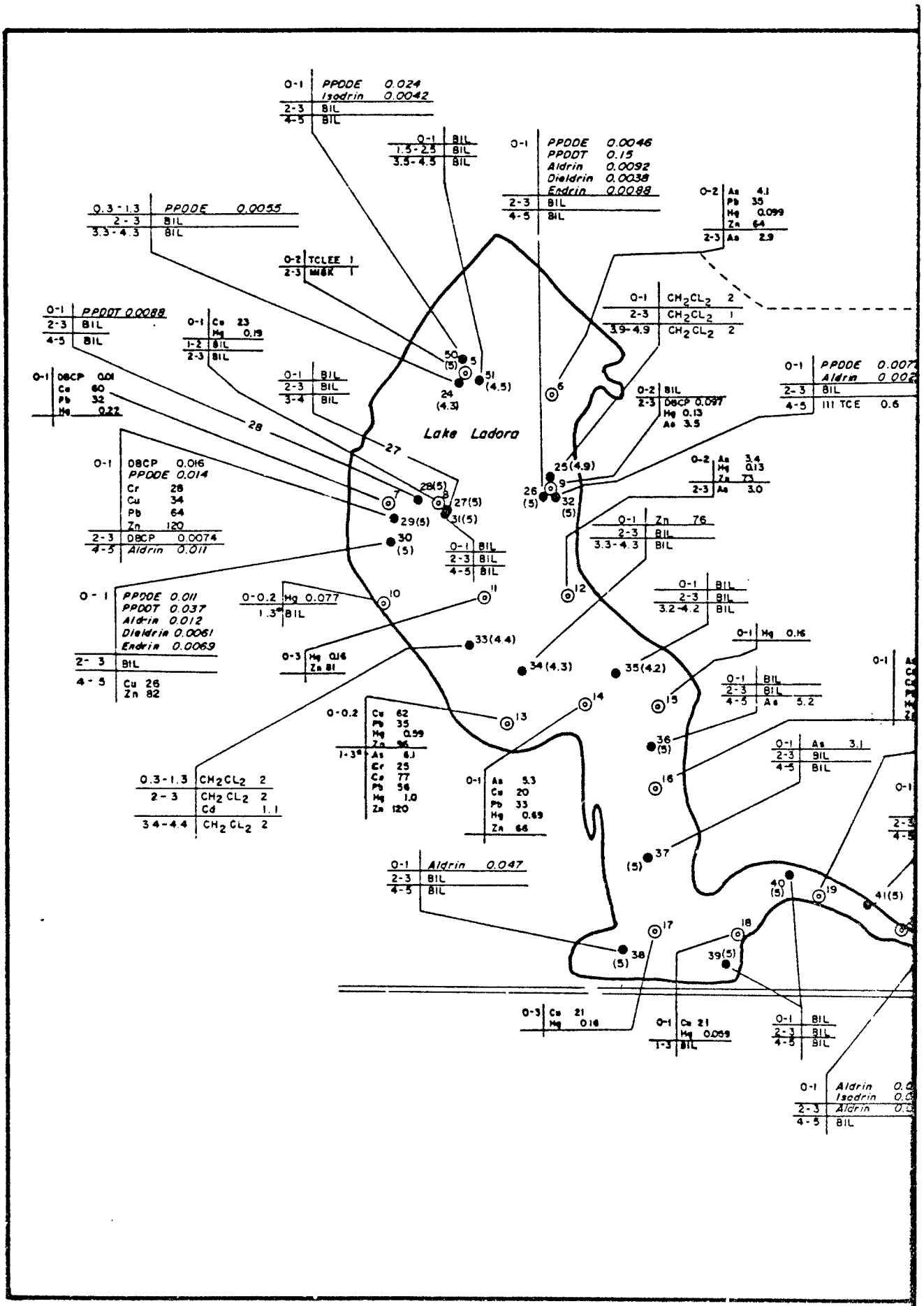
2.5.3 Site Exposure Summary

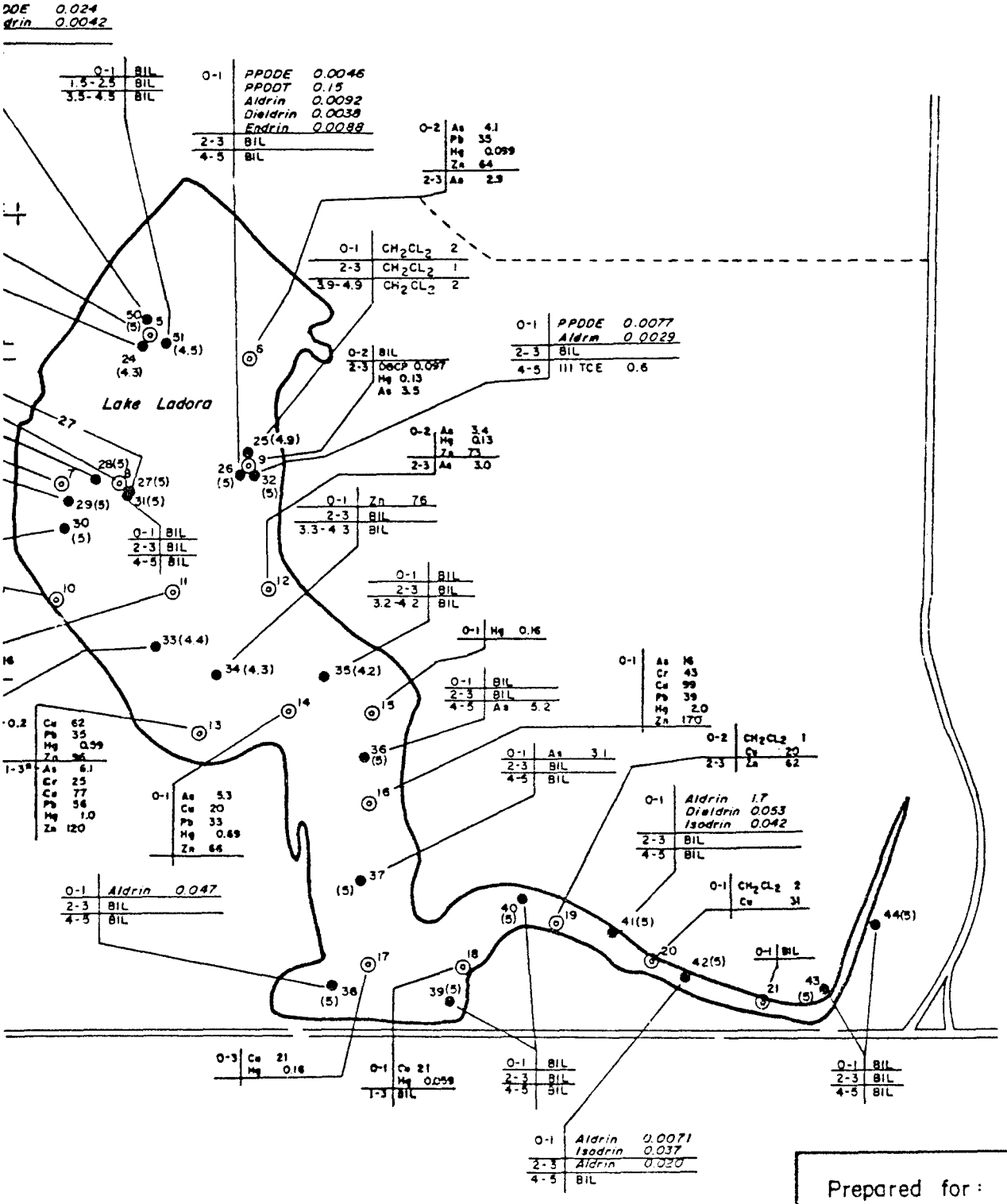
Tables SSA-1e-2 through SSA-1e-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified. Site SSA-1e is considered a lake site, therefore the enclosed space vapor inhalation exposure pathway is not included in the calculation of the cumulative quantity.

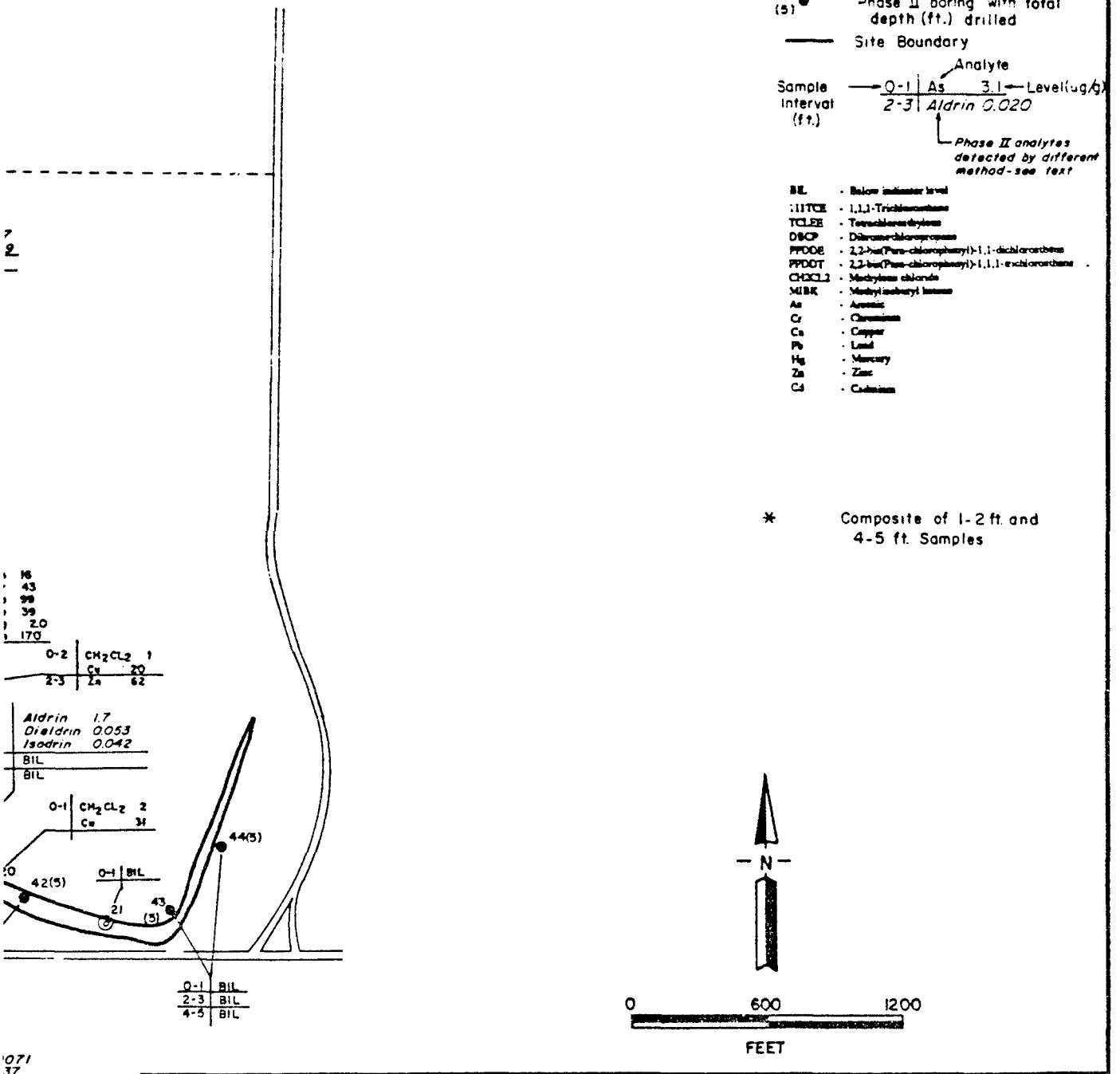
Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Aldrin	Direct	Direct	Direct	Direct	Direct
Arsenic	Direct	Direct	Direct	Direct	Direct
Chromium	Direct	Direct	Direct	Direct	Direct
Dieldrin	--	--	Direct	--	Direct

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.

The results of the soil exposure summary indicate that exposure to contamination from the direct pathways are the primary contributors to the exceedance of the cumulative PPLVs. Site SSA-1e is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).


Lake Ladora
0-1 PPDDE 0.024
Isodrin 0.0042
2-3 BIL
4-5 BIL
0-1 BIL
1.5-2.5 BIL
3.5-4.5 BIL
0-1 PPDDE 0.0046
PPDDT 0.15
Aldrin 0.0092
Dieldrin 0.0038
Endrin 0.0088
2-3 BIL
4-5 BIL
0.3-1.3 PPDDE 0.0055
2-3 BIL
3.3-4.3 BIL
0-2 TCLEE 1
2-3 MIBK 1
0-2 As 4.1
Pb 35
Hg 0.099
Zn 64
2-3 As 2.9
0-1 PPDDT 0.0088
2-3 BIL
4-5 BIL
0-1 Cu 23
Hg 0.19
1-2 BIL
2-3 BIL
0-1 CH2CL2 2
2-3 CH2CL2 1
3.9-4.9 CH2CL2 2
0-1 DBCP 0.01
Cu 60
Pb 32
Hg 0.22
0-1 BIL
2-3 BIL
3-4 BIL
0-1 PPDDE 0.007
Aldrin 0.002
2-3 BIL
4-5 111 TCE 0.6
0-2 BIL
2-3 DBCP 0.097
Hg 0.13
As 3.5
0-1 DBCP 0.016
PPDDE 0.014
Cr 28
Cu 34
Pb 64
Zn 120
2-3 DBCP 0.0074
4-5 Aldrin 0.011
0-2 As 3.4
Hg 0.13
Zn 73
2-3 As 3.0
0-1 Zn 76
2-3 BIL
3.3-4.3 BIL
0-1 BIL
2-3 BIL
4-5 BIL
0-1 PPDDE 0.011
PPDDT 0.037
Aldrin 0.012
Dieldrin 0.0061
Endrin 0.0069
2-3 BIL
4-5 Cu 26
Zn 82
0-0.2 Hg 0.077
1.3 BIL
0-1 BIL
2-3 BIL
3.2-4.2 BIL
0-1 Hg 0.16
0-3 Hg 0.16
Zn 81
0-1 BIL
2-3 BIL
4-5 As 5.2
0-0.2 Cu 62
Pb 35
Hg 0.59
Zn 96
1-3 As 6.1
Cr 25
Co 77
Pb 56
Hg 1.0
Zn 120
0-1 As 3.1
2-3 BIL
4-5 BIL
0.3-1.3 CH2CL2 2
2-3 CH2CL2 2
Cd 1.1
3.4-4.4 CH2CL2 2
0-1 As 5.3
Co 20
Pb 33
Hg 0.69
Zn 66
0-1 Aldrin 0.047
2-3 BIL
4-5 BIL
0-3 Co 21
Hg 0.16
0-1 Co 21
Hg 0.069
1-3 BIL
0-1 BIL
2-3 BIL
4-5 BIL
0-1 Aldrin 0.0
Isodrin 0.0
2-3 Aldrin 0.0
4-5 BIL
50 (5)
5
51 (4.5)
24 (4.3)
6
28
27
7
28(5)
8
27(5)
29(5)
31(5)
30 (5)
9
25(4.9)
26 (5)
32 (5)
10
11
12
33(4.4)
34(4.3)
35(4.2)
13
14
15
36 (5)
16
37 (5)
38 (5)
17
18
39(5)
40 (5)
19
41(5)


Lake Ladora
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Clean
Aberdeen Proving Ground, Mar



Prepared for:

Program Manager's Office for

Rocky Mountain Arsenal Cleanup

Aberdeen Proving Ground, Maryland

FIGURE SSA-1e-1

Phase I and Phase II Analytes Detected Within or Above Indicator Levels, Lake Ladora

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

TABLE SSA-1e-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-1e

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Aldrin	1.7	0-1	41	1.7	0-1	41
PPDDE[1/]	0.024	0-1	50	0.024	0-1	50
PPDDT[2/]	0.15	0-1	26	0.15	0-1	26
Dibromochloropropane	0.097	2-3	9	0.097	2-3	9
Dieldrin	0.053	0-1	41	0.053	0-1	41
Endrin	0.0088	0-1	26	0.0088	0-1	26
Isodrin	0.042	0-1	41	0.042	0-1	41
Methylene chloride	2	0-1	25	2	0-1	25
		3.9-4.9	25		3.9-4.9	25
		0.3-1.3	33		0.3-1.3	33
		0-1	20		0-1	20
		2-3	33		2-3	33
		3.4-4.4	33		3.4-4.4	33
Methylisobutyl ketone	1	2-3	5	1	2-3	5
Tetrachloroethylene	1	0-2	5	1	0-2	5
1,1 1-Trichloroethane	0.6	4-5	32	0.6	4-5	32
Arsenic	16	0-1	16	--	--	--
Chromium	43	0-1	16	--	--	--
Copper	99	0-1	16	--	--	--
Lead	64	0-1	29	--	--	--
Mercury	2.0	0-1	16	--	--	--
Zinc	170	0-1	16	--	--	--

TABLE SSA-1e-1 (Continued)
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-1e

1/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
2/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane

SSA	Southern Study Area
Max.	Maximum
ug/g	microgram per gram
ft	foot/feet

SSA-1e-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPM
ALDRIN	1.5E+00	1.2E+05	1.5E+00	1.1E+00*	1.4E-05	1.1E+00*	0.0E+00
PPODE	7.4E+01	7.1E+06	7.4E+01	3.3E-04	3.4E-09	3.3E-04	0.0E+00
PPDDT	7.4E+01	1.5E+07	7.4E+01	2.0E-03	1.0E-08	2.0E-03	0.0E+00
DIBROMOCHLOROPROPANE	1.8E+01	1.2E+02	1.6E+01	5.4E-03	7.9E-04	6.2E-03	0.0E+00
DIELDRIN	1.6E+00	5.4E+04	1.6E+00	3.4E-02	9.9E-07	3.4E-02	0.0E+00
ENDRIN	2.5E+03	4.4E+07	2.5E+03	3.6E-06	2.0E-10	3.6E-06	0.0E+00
ISODRIN	5.8E+02	8.5E+06	5.8E+02	7.3E-05	4.9E-09	7.3E-05	0.0E+00
METHYLENE CHLORIDE	3.3E+03	9.0E+03	2.4E+03	6.1E-04	2.2E-04	8.3E-04	0.0E+00
METHYLISOBUTYL KETONE	4.1E+05	1.5E+06	3.2E+05	2.4E-06	6.8E-07	3.1E-06	0.0E+00
TETRACHLOROETHYLENE	5.1E+02	9.4E+04	5.1E+02	2.0E-03	1.1E-05	2.0E-03	0.0E+00
1,1,1-TRICHLOROETHANE	7.5E+05	1.6E+07	7.1E+05	8.0E-07	3.7E-08	8.4E-07	0.0E+00
ARSENIC	2.2E+01	0.0E+00	2.2E+01	7.4E-01*	0.0E+00	7.4E-01*	0.0E+00
CHROMIUM	6.9E+01	0.0E+00	6.9E+01	6.2E-01*	0.0E+00	6.2E-01*	0.0E+00
COPPER	4.2E+05	0.0E+00	4.2E+05	2.4E-04	0.0E+00	2.4E-04	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	4.1E-03	0.0E+00	4.1E-03	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	6.0E-04	0.0E+00	6.0E-04	0.0E+00
ZINC	2.0E+06	0.0E+00	2.0E+06	8.6E-05	0.0E+00	8.6E-05	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1e-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	1.2E+05	1.5E+00	1.1E+00*	1.4E-05	1.1E+00*	0.0E+00
PPDDE	7.4E+01	7.1E+06	7.4E+01	3.3E-04	3.4E-09	3.3E-04	0.0E+00
PPDDT	7.4E+01	1.5E+07	7.4E+01	2.0E-03	1.0E-08	2.0E-03	0.0E+00
DIBROMOCHLOROPROPANE	1.8E+01	1.2E+02	1.6E+01	5.4E-03	7.9E-04	6.2E-03	0.0E+00
DIELDRIN	1.6E+00	5.4E+04	1.6E+00	3.4E-02	9.9E-07	3.4E-02	0.0E+00
ENDRIN	2.5E+03	4.4E+07	2.5E+03	3.6E-06	2.0E-10	3.6E-06	0.0E+00
ISODRIN	5.8E+02	8.5E+06	5.8E+02	7.3E-05	4.9E-09	7.3E-05	0.0E+00
METHYLENE CHLORIDE	3.3E+03	9.0E+03	2.4E+03	6.1E-04	2.2E-04	8.3E-04	0.0E+00
METHYLISOBUTYL KETONE	4.1E+05	1.5E+06	3.2E+05	2.4E-06	6.8E-07	3.1E-06	0.0E+00
TETRACHLOROETHYLENE	5.1E+02	9.4E+04	5.1E+02	2.0E-03	1.1E-05	2.0E-03	0.0E+00
1,1,1-TRICHLOROETHANE	7.5E+05	1.6E+07	7.1E+05	8.0E-07	3.7E-08	8.4E-07	0.0E+00
ARSENIC	2.2E+01	0.0E+00	2.2E+01	7.4E-01*	0.0E+00	7.4E-01*	0.0E+00
CHROMIUM	6.9E+01	0.0E+00	6.9E+01	6.2E-01*	0.0E+00	6.2E-01*	0.0E+00
COPPER	4.2E+05	0.0E+00	4.2E+05	2.4E-04	0.0E+00	2.4E-04	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	4.1E-03	0.0E+00	4.1E-03	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	6.0E-04	0.0E+00	6.0E-04	0.0E+00
ZINC	2.0E+06	0.0E+00	2.0E+06	8.6E-05	0.0E+00	8.6E-05	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1e-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPM
ALDRIN	2.1E-01	7.8E+03	2.1E-01	8.2E+00*	2.2E-04	8.2E+00*	0.0E+00
PPDDE	1.0E+01	4.7E+05	1.0E+01	2.4E-03	5.1E-08	2.4E-03	0.0E+00
PPDDT	1.0E+01	1.0E+06	1.0E+01	1.5E-02	1.5E-07	1.5E-02	0.0E+00
DIBROMOCHLOROPROPANE	2.5E+00	1.9E+01	2.2E+00	3.9E-02	5.1E-03	4.4E-02	0.0E+00
DIELDRIN	2.2E-01	3.6E+03	2.2E-01	2.4E-01*	1.5E-05	2.4E-01*	0.0E+00
ENDRIN	1.1E+03	6.7E+06	1.1E+03	8.3E-06	1.3E-09	8.3E-06	0.0E+00
ISODRIN	2.5E+02	1.3E+06	2.5E+02	1.7E-04	3.2E-08	1.7E-04	0.0E+00
METHYLENE CHLORIDE	4.5E+02	1.4E+03	3.4E+02	4.4E-03	1.4E-03	5.8E-03	0.0E+00
METHYLISOBUTYL KETONE	1.7E+05	5.3E+05	1.3E+05	5.8E-06	1.9E-06	7.6E-06	0.0E+00
TETRACHLOROETHYLENE	7.1E+01	1.5E+04	7.1E+01	1.4E-02	6.9E-05	1.4E-02	0.0E+00
1,1,1-TRICHLOROETHANE	3.2E+05	5.9E+06	3.0E+05	1.9E-06	1.0E-07	2.0E-06	0.0E+00
ARSENIC	3.9E+00	0.0E+00	3.9E+00	4.1E+00*	0.0E+00	4.1E+00*	0.0E+00
CHROMIUM	8.8E+00	0.0E+00	8.8E+00	4.9E+00*	0.0E+00	4.9E+00*	0.0E+00
COPPER	2.5E+05	0.0E+00	2.5E+05	4.0E-04	0.0E+00	4.0E-04	0.0E+00
LEAD	9.2E+03	0.0E+00	9.2E+03	6.9E-03	0.0E+00	6.9E-03	0.0E+00
MERCURY	2.0E+03	0.0E+00	2.0E+03	1.0E-03	0.0E+00	1.0E-03	0.0E+00
ZINC	1.1E+06	0.0E+00	1.1E+06	1.6E-04	0.0E+00	1.6E-04	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1e-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	0.0E+00	1.9E+00	9.0E-01*	0.0E+00	9.0E-01*	LS
PPDDE	9.3E+01	0.0E+00	9.3E+01	2.6E-04	0.0E+00	2.6E-04	LS
PPDDT	9.3E+01	0.0E+00	9.3E+01	1.6E-03	0.0E+00	1.6E-03	LS
DIBROMOCHLOROPROPANE	2.3E+01	0.0E+00	2.3E+01	4.3E-03	0.0E+00	4.3E-03	LS
DIELDRIN	2.0E+00	0.0E+00	2.0E+00	2.7E-02	0.0E+00	2.7E-02	LS
ENDRIN	1.4E+03	0.0E+00	1.4E+03	6.4E-06	0.0E+00	6.4E-06	LS
ISODRIN	3.2E+02	0.0E+00	3.2E+02	1.3E-04	0.0E+00	1.3E-04	LS
METHYLENE CHLORIDE	4.1E+03	0.0E+00	4.1E+03	4.9E-04	0.0E+00	4.9E-04	LS
METHYLISOBUTYL KETONE	2.2E+05	0.0E+00	2.2E+05	4.5E-06	0.0E+00	4.5E-06	LS
TETRACHLOROETHYLENE	6.5E+02	0.0E+00	6.5E+02	1.5E-03	0.0E+00	1.5E-03	LS
1,1,1-TRICHLOROETHANE	4.2E+05	0.0E+00	4.2E+05	1.4E-06	0.0E+00	1.4E-06	LS
ARSENIC	2.0E+01	0.0E+00	2.0E+01	8.0E-01*	0.0E+00	8.0E-01*	LS
CHROMIUM	5.5E+01	0.0E+00	5.5E+01	7.8E-01*	0.0E+00	7.8E-01*	LS
COPPER	1.8E+05	0.0E+00	1.8E+05	5.6E-04	0.0E+00	5.6E-04	LS
LEAD	6.5E+03	0.0E+00	6.5E+03	9.8E-03	0.0E+00	9.8E-03	LS
MERCURY	1.4E+03	0.0E+00	1.4E+03	1.4E-03	0.0E+00	1.4E-03	LS
ZINC	7.8E+05	0.0E+00	7.8E+05	2.2E-04	0.0E+00	2.2E-04	LS

*: EI is equal to or exceeds 1.0E-01

SSA-1e-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	1.6E+04	0.0E+00	1.2E-01	1.5E+01*	1.1E-04	1.5E+01*	0.0E+00	LS
PPDDE	5.7E+00	9.5E+05	0.0E+00	5.7E+00	4.2E-03	2.5E-08	4.2E-03	0.0E+00	LS
PPDDT	5.7E+00	2.0E+06	0.0E+00	5.7E+00	2.6E-02	7.5E-08	2.6E-02	0.0E+00	LS
DIBROMOCHLOROPROPANE	1.4E+00	1.6E+01	0.0E+00	1.3E+00	6.9E-02	5.9E-03	7.5E-02	0.0E+00	LS
DIELDRIN	1.2E-01	7.2E+03	0.0E+00	1.2E-01	4.3E-01*	7.4E-06	4.3E-01*	0.0E+00	LS
ENDRIN	2.5E+02	5.8E+06	0.0E+00	2.5E+02	3.5E-05	1.5E-09	3.5E-05	0.0E+00	LS
ISODRIN	5.9E+01	1.1E+06	0.0E+00	5.9E+01	7.1E-04	3.7E-08	7.1E-04	0.0E+00	LS
METHYLENE CHLORIDE	2.5E+02	1.2E+03	0.0E+00	2.1E+02	8.1E-03	1.7E-03	9.7E-03	0.0E+00	LS
METHYL ISOBUTYL KETONE	4.0E+04	2.0E+05	0.0E+00	3.3E+04	2.5E-05	5.1E-06	3.0E-05	0.0E+00	LS
TETRACHLOROETHYLENE	4.1E+01	1.3E+04	0.0E+00	4.1E+01	2.4E-02	8.0E-05	2.4E-02	0.0E+00	LS
1,1,1-TRICHLOROETHANE	7.8E+04	2.2E+06	0.0E+00	7.6E+04	7.7E-06	2.8E-07	7.9E-06	0.0E+00	LS
ARSENIC	1.6E+00	0.0E+00	0.0E+00	1.6E+00	9.9E+00*	0.0E+00	9.9E+00*	0.0E+00	LS
CHROMIUM	1.1E+00	0.0E+00	0.0E+00	1.1E+00	3.8E+01*	0.0E+00	3.8E+01*	0.0E+00	LS
COPPER	5.7E+04	0.0E+00	0.0E+00	5.7E+04	1.7E-03	0.0E+00	1.7E-03	0.0E+00	LS
LEAD	2.2E+03	0.0E+00	0.0E+00	2.2E+03	2.9E-02	0.0E+00	2.9E-02	0.0E+00	LS
MERCURY	4.6E+02	0.0E+00	0.0E+00	4.6E+02	4.3E-03	0.0E+00	4.3E-03	0.0E+00	LS
ZINC	1.4E+05	0.0E+00	0.0E+00	1.4E+05	1.2E-03	0.0E+00	1.2E-03	0.0E+00	LS

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.6 SITE SSA-1f: LAKE MARY (formerly Site 2-17: Lake Ladora and Lake Mary; EBASCO, 1987d/RIC 87216R07 and EBASCO, 1988e/RIC 87216R07A)

2.6.1 Site-Specific Considerations

Figure SSA-1f-1 and Table SSA-1f-1 depict the target contaminants for Site SSA-1f. Borings 1 through 4, 22, 23, and 45 through 49 were included in this exposure assessment, consistent with the Southern SAR. According to site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-1f (EBASCO, 1987d/RIC87216R07).

2.6.2 Spatial Distribution of Measured Contaminant Concentrations

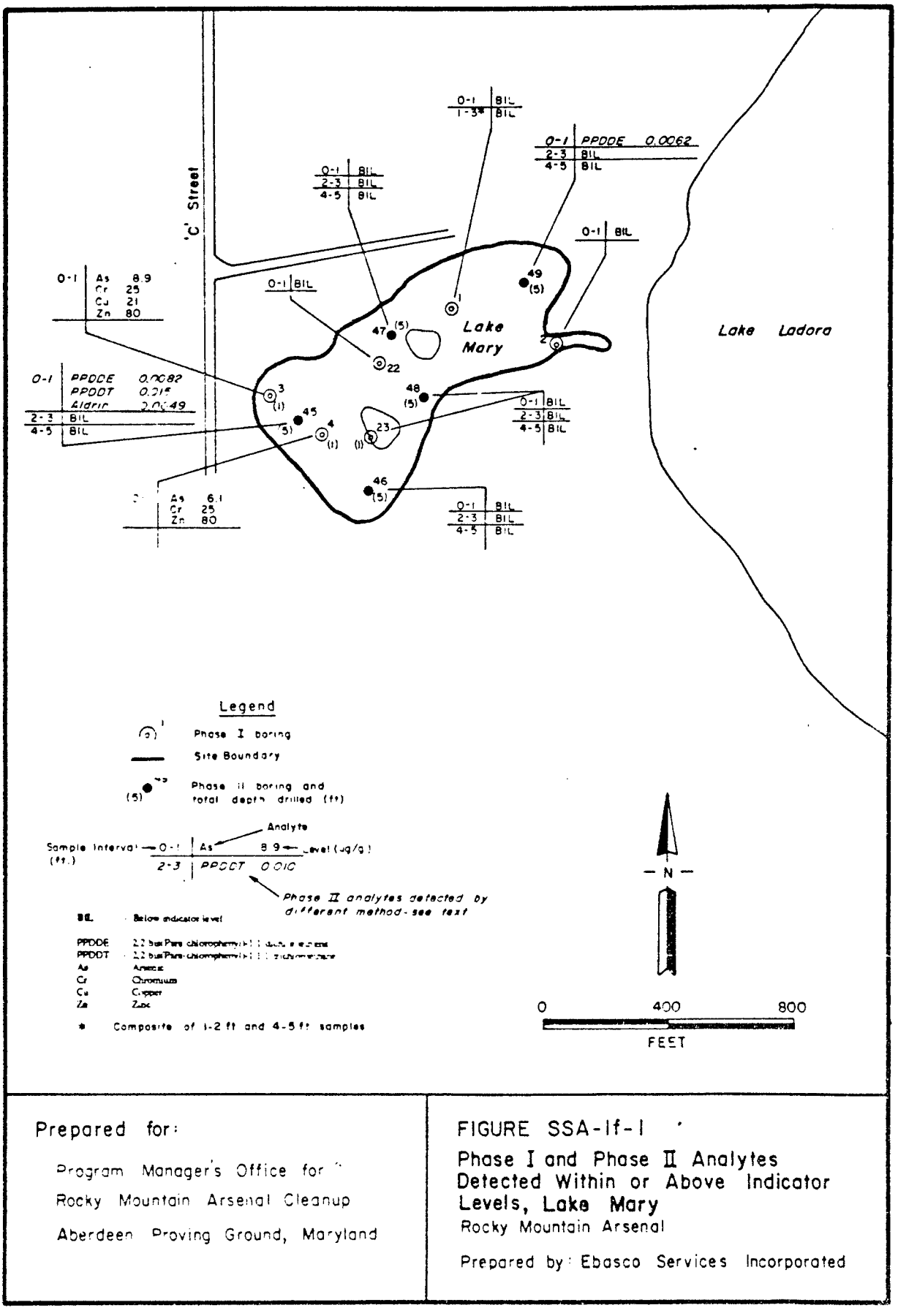
The locations and concentrations of the target contaminants that were detected in Site SSA-1f are depicted on Figure SSA-1f-1. Table SSA-1f-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

2.6.3 Site Exposure Summary

Tables SSA-1f-2 through SSA-1f-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified. Site SSA-1f is considered a lake site, therefore the enclosed space vapor inhalation exposure pathway is not included in the calculation of the cumulative quantity.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
None	--	--	--	--	--

The results of the soil exposure summary indicate that there are no COCs. Site SSA-1f is designated as a Priority 2 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-1f-1

Phase I and Phase II Analytes Detected Within or Above Indicator Levels, Lake Mary

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

TABLE SSA-1f-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-1f

Contaminant	Horizon 1			Horizon 2		
	Max. (ug/g)	Depth (ft)	Boring Number	Max. (ug/g)	Depth (ft)	Boring Number
Aldrin	0.0049	0-1	45	0.0049	0-1	45
PPDDE[1/]	0.0082	0-1	45	0.0082	0-1	45
PPDDT[2/]	0.015	0-1	45	0.015	0-1	45

1/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
2/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-1f-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	4.9E+05	1.5E+00	3.3E-03	1.0E-08	3.3E-03	0.0E+00
PPDDE	7.4E+01	3.0E+07	7.4E+01	1.1E-04	2.8E-10	1.1E-04	0.0E+00
PPDDT	7.4E+01	6.3E+07	7.4E+01	2.0E-04	2.4E-10	2.0E-04	0.0E+00

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1f-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	4.9E+05	1.5E+00	3.3E-03	1.0E-08	3.3E-03	0.0E+00
PPDDE	7.4E+01	3.0E+07	7.4E+01	1.1E-04	2.8E-10	1.1E-04	0.0E+00
PPDDT	7.4E+01	6.3E+07	7.4E+01	2.0E-04	2.4E-10	2.0E-04	0.0E+00

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1f-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	3.3E+04	2.1E-01	2.4E-02	1.5E-07	2.4E-02	0.0E+00
PPDDE	1.0E+01	2.0E+06	1.0E+01	8.0E-04	4.2E-09	8.0E-04	0.0E+00
PPDDT	1.0E+01	4.2E+06	1.0E+01	1.5E-03	3.6E-09	1.5E-03	0.0E+00

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-1f-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	0.0E+00	1.9E+00	2.6E-03	0.0E+00	2.6E-03	LS
PPDDE	9.3E+01	0.0E+00	9.3E+01	8.8E-05	0.0E+00	8.8E-05	LS
PPDDT	9.3E+01	0.0E+00	9.3E+01	1.6E-04	0.0E+00	1.6E-04	LS

SSA-1f-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	6.6E+04	0.0E+00	1.2E-01	4.2E-02	7.5E-08	4.2E-02	0.0E+00	LS
PPDDE	5.7E+00	4.0E+06	0.0E+00	5.7E+00	1.4E-03	2.1E-09	1.4E-03	0.0E+00	LS
PPDDT	5.7E+00	8.4E+06	0.0E+00	5.7E+00	2.6E-03	1.8E-09	2.6E-03	0.0E+00	LS

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.7 SITE SSA-2a: DRAINAGE DITCHES (formerly Site 1-1: Drainage Ditches; EBASCO, 1987e/RIC 87196R01 and EBASCO, 1988f/RIC 87196R01A)

2.7.1 Site-Specific Considerations

Figure SSA-2a-1 and Table SSA-2a-1 depict the target contaminants for Site SSA-2a. Site SSA-2a lies within both the SSA and the South Plants Study Area. It was therefore split, and Borings 1 through 4, 7, 8, and 12 through 18 were included in this analysis, consistent with the Southern SAR. According to the site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-2a (EBASCO,1987e/RIC 87196R01).

2.7.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-2a are shown in Figure SSA-2a-1. Table SSA-2a-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury for Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

2.7.3 Site Exposure Summary

Tables SSA-2a-2 through SSA-2a-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Aldrin	Direct	Direct	Direct	Dir/Ind	Dir/Ind
Dieldrin	Direct	Direct	Direct	Direct	Dir/Ind
Methylene chloride	--	--	--	Indirect	Indirect

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

The results of the soil exposure summary indicate that exposure to contamination from the direct and indirect pathways both contribute to the exceedance of the cumulative PPLVs. Site SSA-2a is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).

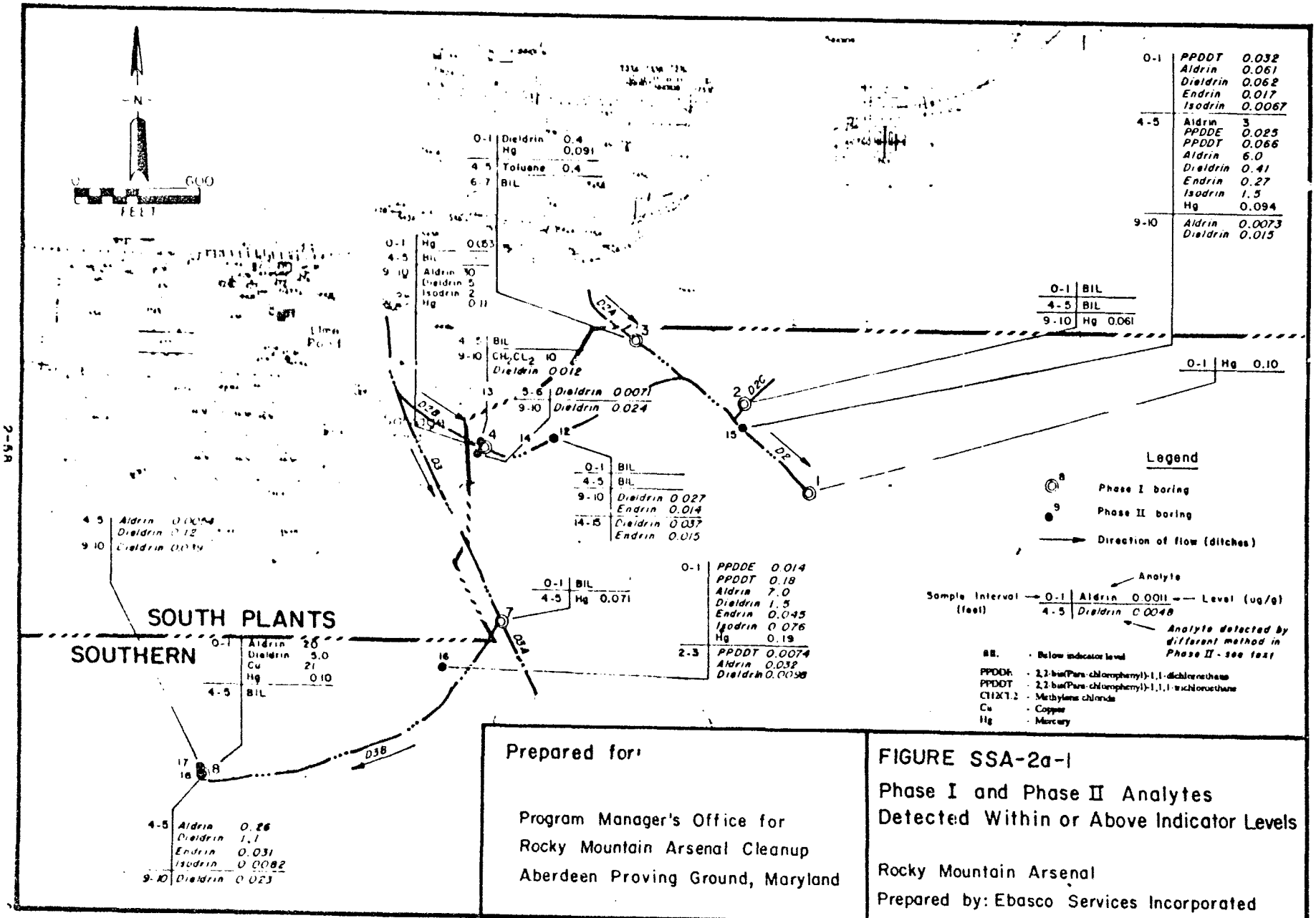

N
600
FEET
SOUTH PLANTS
SOUTHERN
Legend
Phase I boring
Phase II boring
Direction of flow (ditches)
Analyte
Sample Interval (feet)
Level (ug/g)
Analyte detected by different method in Phase II - see text
BB. - Below indicator level
PPDDE - 2,2-bis(Para-chlorophenyl)-1,1-dichloroethane
PPDDT - 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane
CH2Cl2 - Methylene chloride
Cu - Copper
Hg - Mercury
Prepared for:
Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland
FIGURE SSA-2a-1
Phase I and Phase II Analytes
Detected Within or Above Indicator Levels
Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

TABLE SSA-2a-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-2a

Contaminant	Horizon 1			Horizon 2		
	Max. (ug/g)	Depth (ft)	Boring Number	Max. (ug/g)	Depth (ft)	Boring Number
Aldrin	30	9-10	4	30	9-10	4
PPDDE[1/]	0.025	4-5	15	0.025	4-5	15
PPDDT[2/]	0.18	0-1	16	0.18	0-1	16
Dieldrin	5	9-10	4	5	9-10	4
		0-1	8		0-1	8
Endrin	0.27	4-5	15	0.27	4-5	15
Isodrin	2	9-10	4	2	9-10	4
Methylene chloride	10	9-10	13	10	9-10	13
Toluene	0.4	4-5	3	0.4	4-5	3
Mercury	0.19	0-1	16	--	--	--

1/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
2/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-2a-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	1.6E+04	1.5E+00	2.0E+01*	1.9E-03	2.0E+01*	0.0E+00
PPDDE	7.4E+01	9.5E+05	7.4E+01	3.4E-04	2.6E-08	3.4E-04	0.0E+00
PPDDT	7.4E+01	2.0E+06	7.4E+01	2.4E-03	9.0E-08	2.4E-03	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	3.2E+00*	7.0E-04a	3.2E+00*	0.0E+00
ENDRIN	2.5E+03	5.8E+06	2.5E+03	1.1E-04	4.6E-08	1.1E-04	0.0E+00
ISODRIN	5.8E+02	1.1E+06	5.8E+02	3.5E-03	1.8E-06	3.5E-03	0.0E+00
METHYLENE CHLORIDE	3.3E+03	1.4E+03	9.7E+02	3.1E-03	7.3E-03	1.0E-02	0.0E+00
TOLUENE	2.5E+06	3.6E+06	1.5E+06	1.6E-07	1.1E-07	2.7E-07	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	5.7E-05	0.0E+00	5.7E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2a-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	1.6E+04	1.5E+00	2.0E+01*	1.9E-03	2.0E+01*	0.0E+00
PPDDE	7.4E+01	9.5E+05	7.4E+01	3.4E-04	2.6E-08	3.4E-04	0.0E+00
PPDDT	7.4E+01	2.0E+06	7.4E+01	2.4E-03	9.0E-08	2.4E-03	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	3.2E+00*	7.0E-04a	3.2E+00*	0.0E+00
ENDRIN	2.5E+03	5.8E+06	2.5E+03	1.1E-04	4.6E-08	1.1E-04	0.0E+00
ISODRIN	5.8E+02	1.1E+06	5.8E+02	3.5E-03	1.8E-06	3.5E-03	0.0E+00
METHYLENE CHLORIDE	3.3E+03	1.4E+03	9.7E+02	3.1E-03	7.3E-03	1.0E-02	0.0E+00
TOLUENE	2.5E+06	3.6E+06	1.5E+06	1.6E-07	1.1E-07	2.7E-07	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	5.7E-05	0.0E+00	5.7E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2a-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	1.0E+03	2.1E-01	1.4E+02*	2.9E-02	1.4E+02*	0.0E+00
PPDDE	1.0E+01	6.3E+04	1.0E+01	2.4E-03	4.0E-07	2.4E-03	0.0E+00
PPDDT	1.0E+01	1.3E+05	1.0E+01	1.8E-02	1.4E-06	1.8E-02	0.0E+00
DIELDRIN	2.2E-01	1.0E+06	2.2E-01	2.3E+01*	1.1E-02a	2.3E+01*	0.0E+00
ENDRIN	1.1E+03	9.0E+05	1.1E+03	2.6E-04	3.0E-07	2.6E-04	0.0E+00
ISODRIN	2.5E+02	1.8E+05	2.5E+02	8.1E-03	1.1E-05	8.1E-03	0.0E+00
METHYLENE CHLORIDE	4.5E+02	2.1E+02	1.4E+02	2.2E-02	4.7E-02	6.9E-02	0.0E+00
TOLUENE	1.1E+06	1.3E+06	5.9E+05	3.8E-07	3.1E-07	6.8E-07	0.0E+00
MERCURY	2.0E+03	0.0E+00	2.0E+03	9.6E-05	0.0E+00	9.6E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2a-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	1.3E+02	1.9E+00	1.6E+01*	2.4E-01*	1.6E+01*	0.0E+00
PPDDE	9.3E+01	1.9E+01	1.6E+01	2.7E-04	1.3E-03	1.6E-03	0.0E+00
PPDDT	9.3E+01	1.9E+01	1.6E+01	1.9E-03	9.3E-03	1.1E-02	0.0E+00
DIELDRIN	2.0E+00	1.0E+06	1.9E+00	2.5E+00*	8.7E-02a	2.6E+00*	0.0E+00
ENDRIN	1.4E+03	1.6E+04	1.3E+03	2.0E-04	1.7E-05	2.1E-04	0.0E+00
ISODRIN	3.2E+02	3.0E+03	2.9E+02	6.2E-03	6.6E-04	6.9E-03	0.0E+00
METHYLENE CHLORIDE	4.1E+03	3.7E+00	3.7E+00	2.4E-03	2.7E+00*	2.7E+00*	0.0E+00
TOLUENE	1.4E+06	5.5E+05	3.9E+05	2.9E-07	7.3E-07	1.0E-06	0.0E+00
MERCURY	1.4E+03	0.0E+00	1.4E+03	1.4E-04	0.0E+00	1.4E-04	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2a-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	2.1E+03	4.2E+01	1.2E-01	2.6E+02*	7.3E-01*	2.6E+02*	0.0E+00	0.0E+00
PPDDE	5.7E+00	1.3E+05	1.9E+01	4.4E+00	4.4E-03	1.3E-03	5.7E-03	0.0E+00	0.0E+00
PPDOT	5.7E+00	2.7E+05	1.9E+01	4.4E+00	3.1E-02	9.3E-03	4.1E-02	0.0E+00	0.0E+00
DIELDRIN	1.2E-01	9.6E+02	1.9E+01	1.2E-01	4.1E+01*	2.7E-01*	4.1E+01*	0.0E+00	0.0E+00
ENDRIN	2.5E+02	7.7E+05	1.6E+04	2.5E+02	1.1E-03	1.8E-05	1.1E-03	0.0E+00	0.0E+00
ISODRIN	5.9E+01	1.5E+05	3.0E+03	5.8E+01	3.4E-02	6.7E-04	3.4E-02	0.0E+00	0.0E+00
METHYLENE CHLORIDE	2.5E+02	1.8E+02	3.7E+00	3.5E+00	4.0E-02	2.8E+00*	2.8E+00*	0.0E+00	0.0E+00
TOLUENE	2.6E+05	4.8E+05	1.6E+06	1.5E+05	1.5E-06	1.1E-06	2.6E-06	0.0E+00	0.0E+00
MERCURY	4.6E+02	0.0E+00	0.0E+00	4.6E+02	4.1E-04	0.0E+00	4.1E-04	0.0E+00	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.8 SITE SSA-2b: SAND CREEK LATERAL (formerly Site 2-1: Drainage Ditches; EBASCO 1987f/RIC 87216R06 and EBASCO, 1988g/RIC 87216R06A)

2.8.1 Site-Specific Considerations

Figures SSA-2b-1 and SSA-2b-2 and Table SSA-2b-1 depict the target contaminants for Site SSA-2b. Site SSA-2b lies within both the SSA and the South Plants Study Area. It was therefore split, and data from soil borings 1, 2, 5, 10, 12, 15/16, 19 through 27, 48, and 49 included in this analysis, consistent with the Southern SAR. The historical search conducted under the contamination assessment revealed that bicycloheptadiene, dicyclopentadiene, and xylene contamination may have been present on the site (EBASCO, 1987f/RIC 87216R06), but they were not detected during the Phase I and Phase II investigations. Fluoranthene and pyrene were not positively identified; therefore, they are not considered further in this analysis. According to the site history, no other chemicals from the RMA target contaminant list were suspected to be present in Site SSA-2b (EBASCO, 1987f/RIC 87216R06).

2.8.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-2b are shown in Figures SSA-2b-1 and SSA-2b-2. Table SSA-2b-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

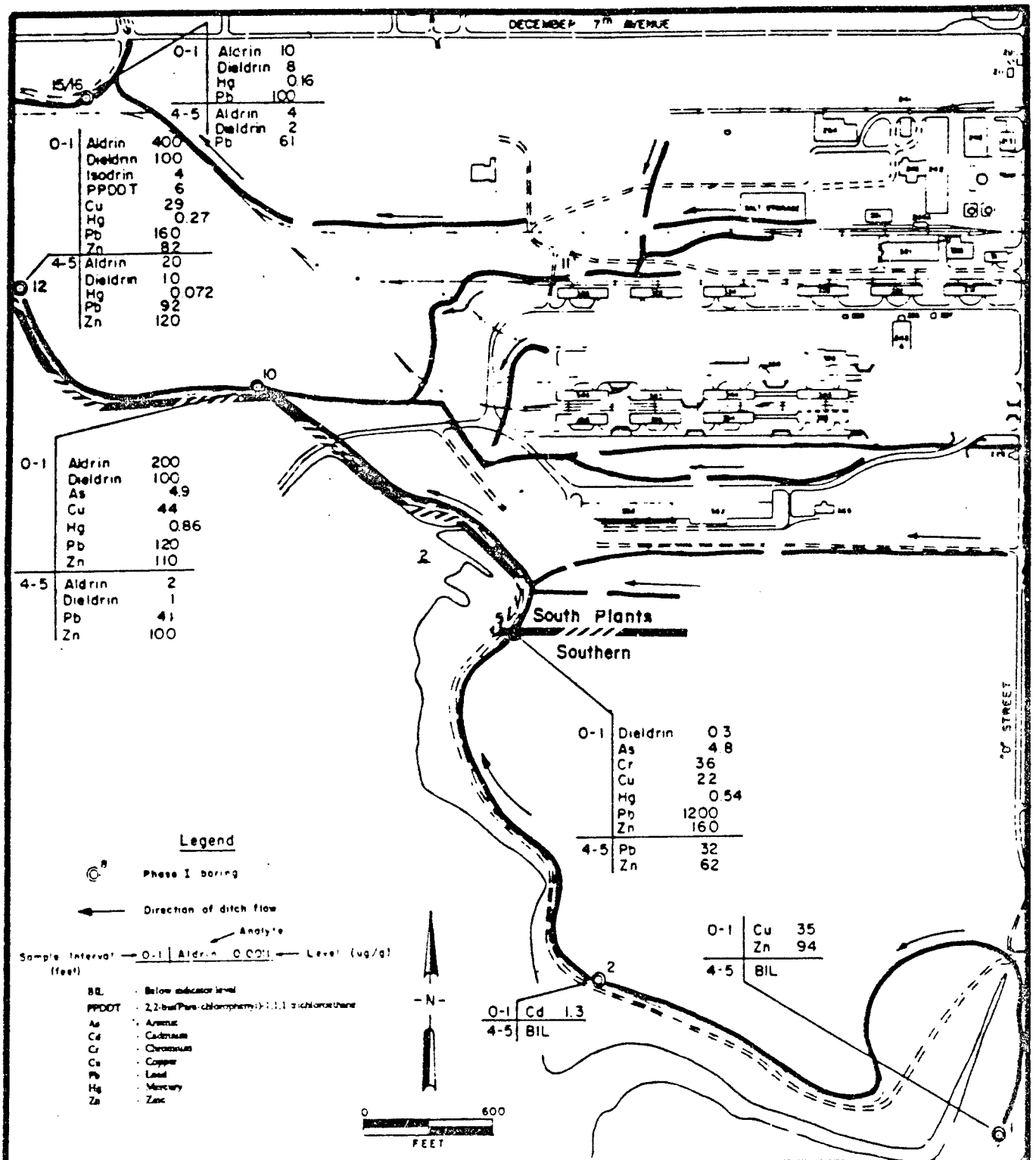
2.8.3 Site Exposure Summary

Tables SSA-2b-2 through SSA-2b-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Aldrin	Direct	Direct	Dir/Ind	Dir/Ind	Dir/Ind
Dieldrin	Direct	Direct	Dir/Ind	Dir/Ind	Dir/Ind
Chlordane	--	--	Direct	--	Direct
PPDDE	--	--	Direct	--	Direct
PPDDT	--	--	Direct	Indirect	Dir/Ind
Lead	--	--	Direct	Direct	Direct
Isodrin	--	--	--	Indirect	Indirect

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

The results of the soil exposure summary indicate that exposure to contamination from the direct and indirect pathways both contribute to the exceedance of the cumulative PPLVs. Site SSA-2b is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



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Program Manager's Office for

Rocky Mountain Arsenal Cleanup

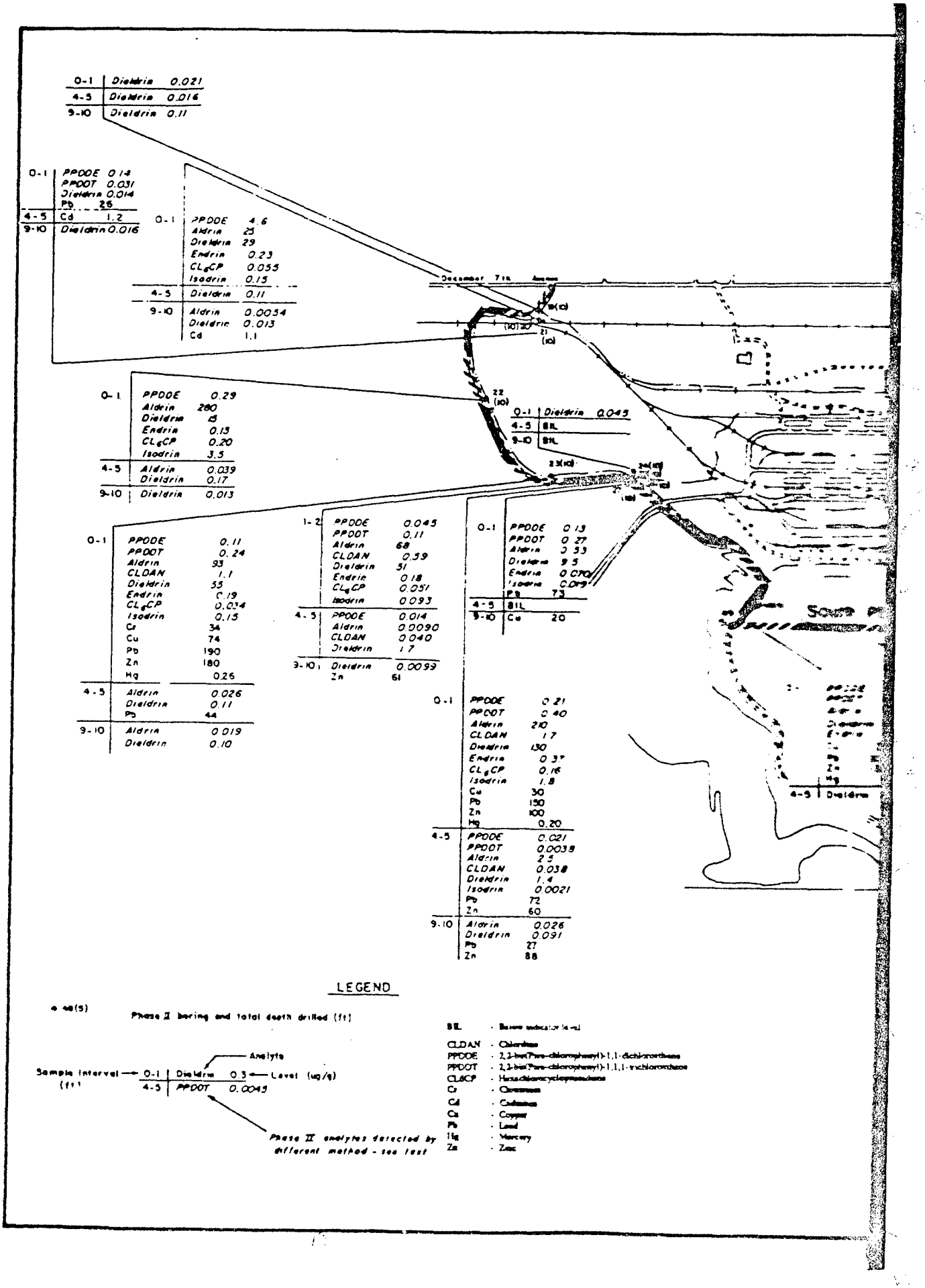
Aberdeen Proving Ground, Maryland

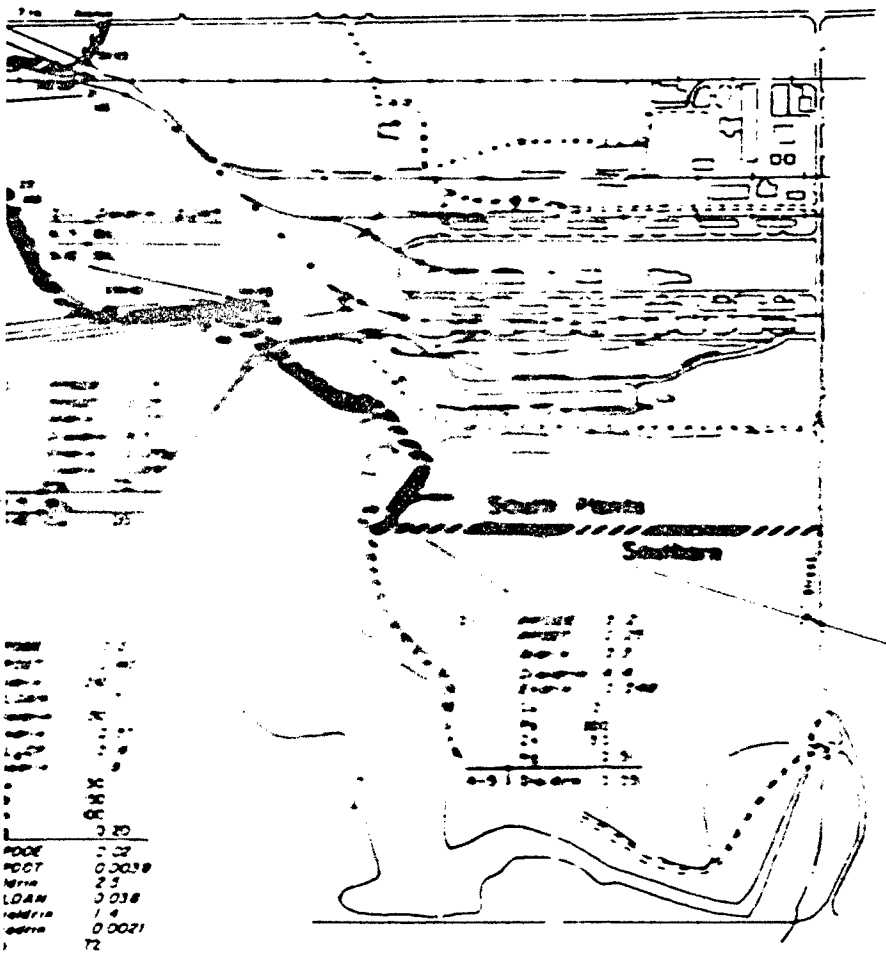
FIGURE SSA-2b-1

Phase I Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated


0-1 Dieldrin 0.021
4-5 Dieldrin 0.016
9-10 Dieldrin 0.11
0-1 PPDDE 0.14
PPDOT 0.031
Dieldrin 0.014
Pb 26
4-5 Cd 1.2
9-10 Dieldrin 0.016
0-1 PPDDE 4.6
Aldrin 25
Dieldrin 29
Endrin 0.23
CL6CP 0.055
Isodrin 0.15
4-5 Dieldrin 0.11
9-10 Aldrin 0.0054
Dieldrin 0.013
Cd 1.1
0-1 PPDDE 0.29
Aldrin 280
Dieldrin 15
Endrin 0.13
CL6CP 0.20
Isodrin 3.5
4-5 Aldrin 0.039
Dieldrin 0.17
9-10 Dieldrin 0.013
0-1 PPDDE 0.11
PPDOT 0.24
Aldrin 93
CLDAN 1.1
Dieldrin 55
Endrin 0.19
CL6CP 0.034
Isodrin 0.15
Cr 34
Cu 74
Pb 190
Zn 180
Hg 0.26
4-5 Aldrin 0.026
Dieldrin 0.11
Pb 44
9-10 Aldrin 0.019
Dieldrin 0.10
1-2 PPDDE 0.045
PPDOT 0.11
Aldrin 68
CLDAN 0.59
Dieldrin 51
Endrin 0.18
CL6CP 0.051
Isodrin 0.093
4-5 PPDDE 0.014
Aldrin 0.0090
CLDAN 0.040
Dieldrin 1.7
9-10 Dieldrin 0.0099
Zn 61
0-1 PPDDE 0.13
PPDOT 0.27
Aldrin 0.53
Dieldrin 9.5
Endrin 0.070
Isodrin 0.079
Pb 73
4-5 BIL
9-10 Cu 20
0-1 PPDDE 0.21
PPDOT 0.40
Aldrin 210
CLDAN 1.7
Dieldrin 130
Endrin 0.37
CL6CP 0.16
Isodrin 1.8
Cu 30
Pb 150
Zn 100
Hg 0.20
4-5 PPDDE 0.021
PPDOT 0.0039
Aldrin 2.5
CLDAN 0.038
Dieldrin 1.4
Isodrin 0.0021
Pb 72
Zn 60
9-10 Aldrin 0.026
Dieldrin 0.091
Pb 27
Zn 88
0-1 Dieldrin 0.049
4-5 BIL
9-10 BIL
4-5 Dieldrin
December 7th Avenue
LEGEND
Phase II boring and total depth drilled (ft)
Sample Interval (ft)
Analyte
Level (ug/g)
0-1 Dieldrin 0.3
4-5 PPDOT 0.0049
Phase II analytes detected by different method - see text
BIL - Below indicator level
CLDAN - Chlordane
PPDDE - 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
PPDOT - 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane
CL6CP - Hexachlorocyclopentadiene
Cr - Chromium
Cd - Cadmium
Cu - Copper
Pb - Lead
Hg - Mercury
Zn - Zinc



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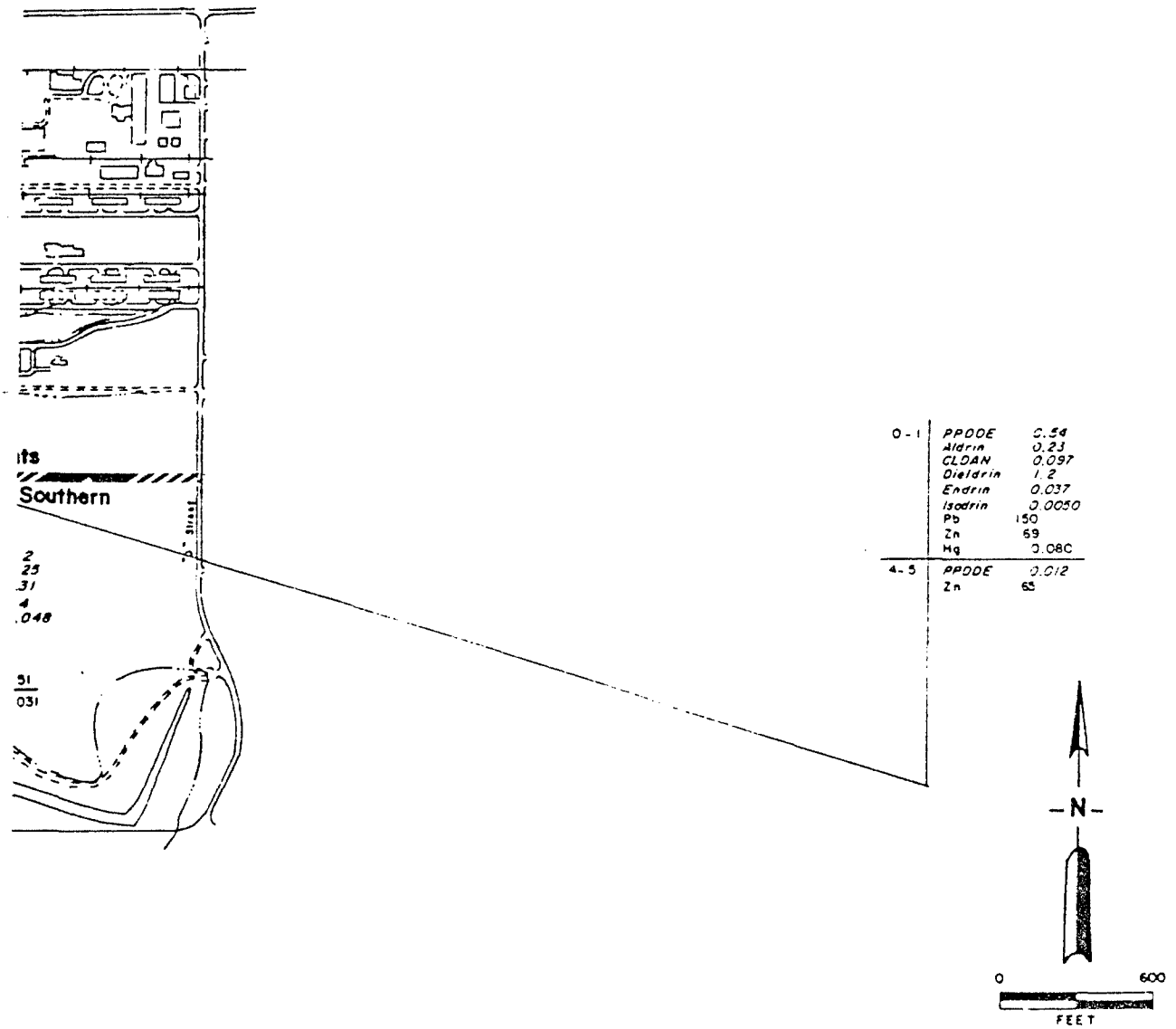

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FIGURE SSA-2b-2

Phase II Anulytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

TABLE SSA-2b-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-2b

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Aldrin	400	0-1	12	400	0-1	12
Chlordane	1.7	0-1	26+1/	1.7	0-1	26+
PPDDE2/	4.6	0-1	20+	4.6	0-1	20+
PPDDT3/	6	0-1	12	6.0	0-1	12
Dieldrin	130	0-1	26+	130	0-1	26+
Endrin	0.37	0-1	26+	0.37	0-1	26+
Hexachlorocyclopentadiene	0.20	0-1	22+	0.20	0-1	22+
Isodrin	4	0-1	12	4	0-1	12
Copper	74	0-1	23+	--	--	--
Lead	1200	0-1	5	--	--	--
Mercury	0.86	0-1	10	--	--	--
Zinc	180	0-1	23+	--	--	--

1/ + Boring is in Figure SSA-2b-2.
2/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
3/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-2b-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	1.0E+06	1.5E+00	2.7E+02*	1.9E-02a	2.7E+02*	0.0E+00
CHLORDANE	1.0E+01	2.3E+06	2.0E+01	8.7E-02	7.5E-07	8.7E-02	0.0E+00
PPDDE	7.4E+01	1.3E+06	7.4E+01	6.3E-02	3.6E-06	6.3E-02	0.0E+00
PPDDT	7.4E+01	1.0E+06	7.4E+01	8.2E-02	2.3E-06a	8.2E-02	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	8.3E+01*	1.4E-02a	8.3E+01*	0.0E+00
ENDRIN	2.5E+03	7.7E+06	2.5E+03	1.5E-04	4.8E-08	1.5E-04	0.0E+00
HEXACHLOROCYCLOPENTADIENE	1.7E+04	3.2E+02	3.1E+02	1.2E-05	6.3E-04	6.4E-04	0.0E+00
ISODRIN	5.8E+02	1.5E+06	5.8E+02	6.9E-03	2.6E-06	6.9E-03	0.0E+00
COPPER	4.2E+05	0.0E+00	4.2E+05	1.8E-04	0.0E+00	1.8E-04	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	7.8E-02	0.0E+00	7.8E-02	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	2.6E-04	0.0E+00	2.6E-04	0.0E+00
ZINC	2.0E+06	0.0E+00	2.0E+06	9.1E-05	0.0E+00	9.1E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2b-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPM
ALDRIN	1.5E+00	1.0E+06	1.5E+00	2.7E+02*	1.9E-02a	2.7E+02*	0.0E+00
CHLORDANE	2.0E+01	2.3E+06	2.0E+01	8.7E-02	7.5E-07	8.7E-02	0.0E+00
PPDDE	7.4E+01	1.3E+06	7.4E+01	6.3E-02	3.6E-06	6.3E-02	0.0E+00
PPDDT	7.4E+01	1.0E+06	7.4E+01	8.2E-02	2.3E-06a	8.2E-02	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	8.3E+01*	1.4E-02a	8.3E+01*	0.0E+00
ENDRIN	2.5E+03	7.7E+06	2.5E+03	1.5E-04	4.8E-08	1.5E-04	0.0E+00
HEXACHLOROCYCLOPENTADIENE	1.7E+04	3.2E+02	3.1E+02	1.2E-05	6.3E-04	6.4E-04	0.0E+00
ISODRIN	5.8E+02	1.5E+06	5.8E+02	6.9E-03	2.6E-06	6.9E-03	0.0E+00
COPPER	4.2E+05	0.0E+00	4.2E+05	1.8E-04	0.0E+00	1.8E-04	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	7.8E-02	0.0E+00	7.8E-02	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	2.6E-04	0.0E+00	2.6E-04	0.0E+00
ZINC	2.0E+06	0.0E+00	2.0E+06	9.1E-05	0.0E+00	9.1E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2b-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	1.4E+03	2.1E-01	1.9E+03*	2.9E-01*	1.9E+03*	0.0E+00
CHLORDANE	2.7E+00	1.5E+05	2.7E+00	6.3E-01*	1.1E-05	6.3E-01*	0.0E+00
PPDDE	1.0E+01	8.4E+04	1.0E+01	4.5E-01*	5.5E-05	4.5E-01*	0.0E+00
PPDDT	1.0E+01	1.0E+06	1.0E+01	5.9E-01*	3.4E-05a	5.9E-01*	0.0E+00
DIELDRIN	2.2E-01	6.3E+02	2.2E-01	6.0E+02*	2.1E-01*	6.0E+02*	0.0E+00
ENDRIN	1.1E+03	1.2E+06	1.1E+03	3.5E-04	3.1E-07	3.5E-04	0.0E+00
HEXACHLOROCYCLOPENTADIENE	5.7E+03	1.1E+02	1.1E+02	3.5E-05	1.7E-03	1.8E-03	0.0E+00
ISODRIN	2.5E+02	2.3E+05	2.5E+02	1.6E-02	1.7E-05	1.6E-02	0.0E+00
COPPER	2.5E+05	0.0E+00	2.5E+05	3.0E-04	0.0E+00	3.0E-04	0.0E+00
LEAD	9.2E+03	0.0E+00	9.2E+03	1.3E-01*	0.0E+00	1.3E-01*	0.0E+00
MERCURY	2.0E+03	0.0E+00	2.0E+03	4.4E-04	0.0E+00	4.4E-04	0.0E+00
ZINC	1.1E+06	0.0E+00	1.1E+06	1.7E-04	0.0E+00	1.7E-04	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2b-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	1.3E+02	1.9E+00	2.1E+02*	3.2E+00*	2.1E+02*	0.0E+00
CHLORDANE	2.5E+01	1.4E+04	2.5E+01	6.9E-02	1.3E-04	6.9E-02	0.0E+00
PPDDE	9.3E+01	7.6E+03	9.2E+01	4.9E-02	6.0E-04	5.0E-02	0.0E+00
PPDDT	9.3E+01	1.9E+01	1.6E+01	6.4E-02	3.1E-01*	3.7E-01*	0.0E+00
DIELDRIN	2.0E+00	5.8E+01	1.9E+00	6.5E+01*	2.3E+00*	6.8E+01*	0.0E+00
ENDRIN	1.4E+03	2.9E+02	2.4E+02	2.7E-04	1.3E-03	1.6E-03	0.0E+00
HEXACHLOROCYCLOPENTADIENE	5.5E+03	1.9E+01	1.9E+01	3.7E-05	1.0E-02	1.0E-02	0.0E+00
ISODRIN	3.2E+02	7.5E+00	7.3E+00	1.2E-02	5.4E-01*	5.5E-01*	0.0E+00
COPPER	1.8E+05	0.0E+00	1.8E+05	4.2E-04	0.0E+00	4.2E-04	0.0E+00
LEAD	6.5E+03	0.0E+00	6.5E+03	1.8E-01*	0.0E+00	1.8E-01*	0.0E+00
MERCURY	1.4E+03	0.0E+00	1.4E+03	6.2E-04	0.0E+00	6.2E-04	0.0E+00
ZINC	7.8E+05	0.0E+00	7.8E+05	2.3E-04	0.0E+00	2.3E-04	0.0E+00

*: EI is equal to or exceeds 1.0E-01

SSA-2b-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	2.8E+03	4.2E+01	1.2E-01	3.4E+03*	9.7E+00*	3.4E+03*	0.0E+00	0.0E+00
CHLORDANE	1.5E+00	3.0E+05	4.5E+03	1.5E+00	1.1E+00*	3.8E-04	1.1E+00*	0.0E+00	0.0E+00
PPDDE	5.7E+00	1.7E+05	2.5E+03	5.7E+00	8.0E-01*	1.8E-03	8.1E-01*	0.0E+00	0.0E+00
PPDDT	5.7E+00	3.6E+05	1.9E+01	4.4E+00	1.0E+00*	3.1E-01*	1.4E+00*	0.0E+00	0.0E+00
DIELDRIN	1.2E-01	1.3E+03	1.9E+01	1.2E-01	1.1E+03*	6.9E+00*	1.1E+03*	0.0E+00	0.0E+00
ENDRIN	2.5E+02	1.0E+06	8.6E+02	2.0E+02	1.5E-03	4.3E-04	1.9E-03	0.0E+00	0.0E+00
HEXACHLOROCYCLOPENTADIENE	3.8E+02	4.2E+01	5.8E+01	2.3E+01	5.2E-04	8.2E-03	8.7E-03	0.0E+00	0.0E+00
ISODRIN	5.9E+01	2.0E+05	2.2E+01	1.6E+01	6.8E-02	1.8E-01*	2.5E-01*	0.0E+00	0.0E+00
COPPER	5.7E+04	0.0E+00	0.0E+00	5.7E+04	1.3E-03	0.0E+00	1.3E-03	0.0E+00	0.0E+00
LEAD	2.2E+03	0.0E+00	0.0E+00	2.2E+03	5.5E-01*	0.0E+00	5.5E-01*	0.0E+00	0.0E+00
MERCURY	4.6E+02	0.0E+00	0.0E+00	4.6E+02	1.9E-03	0.0E+00	1.9E-03	0.0E+00	0.0E+00
ZINC	1.4E+05	0.0E+00	0.0E+00	1.4E+05	1.3E-03	0.0E+00	1.3E-03	0.0E+00	0.0E+00

*: EI is equal to or exceeds 1.0E-01

2.9 SITE SSA-2c: DRAINAGE DITCH AND OVERFLOW BASIN (formerly Site 3-2/3-3: Drainage Ditch and Overflow Basin; EBASCO, 1987g/RIC 87336R12 and EBASCO, 1988h/RIC 87336R12A)

2.9.1 Site-Specific Considerations

Figure SSA-2c-1 and Tables SSA-2c-1 and SSA-2c-2 depict the target contaminants for Site SSA-2c. Borings 1 through 11, 15, and 16 from Contamination Assessment Report (CAR) 3-3 and 1, 12, 13, and 14 from CAR 3-2 were included in the exposure assessment, consistent with the Southern SAR. According to the site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-2c (EBASCO, 1987g/RIC 87336R12).

2.9.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-2c are shown in Figure SSA-2c-1. 1,1,2,2-Tetrachloroethane, occurring in Borings 1 (4-5 ft), 2 (0-1 ft, 4-5 ft and 9-10 ft), 3 (4-5 ft), 4 (4-5 ft and 9-10 ft), 5 (0-1 ft and 4-5 ft), and 15 (0-1 ft) was not included in the figure since it was not considered a target contaminant during Phase I and Phase II investigations. Although not shown in this figure, this nontarget compound was included in the Southern SAR and in this exposure assessment because it passed through the screening process performed in the RMA Chemical Index (EBASCO, 1988b/RIC 88357R01).

Table SSA-2c-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Table SSA-2c-2 summarizes the maximum concentrations detected in groundwater together with the well number, location, sampling, interval, and depth to groundwater.

2.9.3 Site Exposure Summary

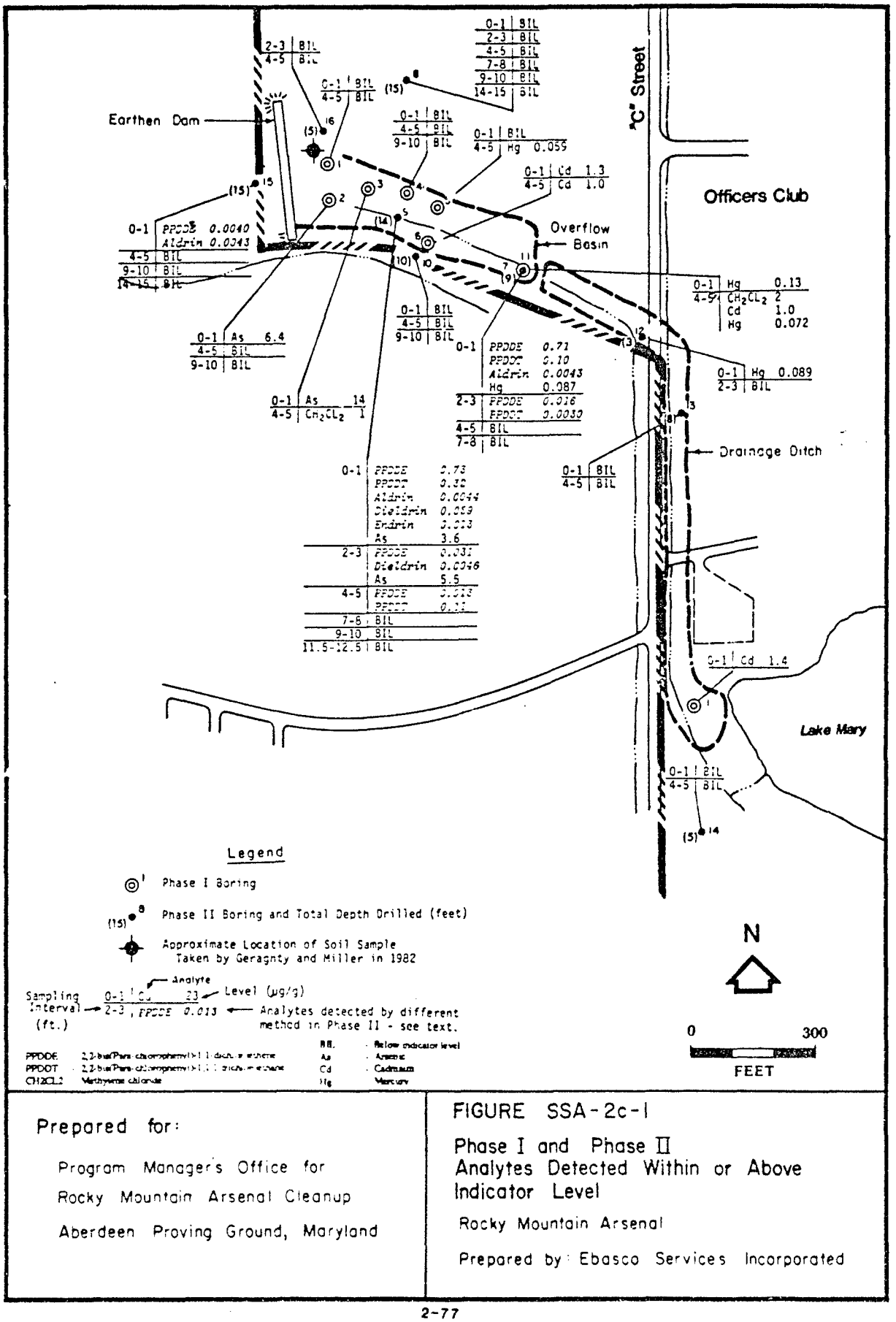
Tables SSA-2c-3 through SSA-2c-7 present Draft PPLVs EIs, and VEIs for each site contaminant. Since the depth to groundwater below site SSA-2c is greater than 10 ft, the enclosed space vapor inhalation SPPPLV is included in the calculation of the cumulative quantity. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Arsenic	Direct	Direct	Direct	Direct	Direct
Dieldrin	--	--	Direct	--	Direct
Methylene chloride	--	--	--	Indirect	Indirect
1,1,2,2-Tetra-chloroethane	--	--	Direct	Indirect	Dir/Ind
PPDDE	--	--	--	--	Direct

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

The results of the soil exposure summary indicate that exposure to contamination from the direct and indirect pathways both contribute to the exceedance of the cumulative PPLVs. Site SSA-2c is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).

No groundwater contaminants result in an unacceptable exposure due to vapor inhalation as indicated by VEI values less than 1.



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-2c-1

Phase I and Phase II
Analytes Detected Within or Above
Indicator Level

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

TABLE SSA-2c-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-2c

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Aldrin	0.0044	0-1	9	0.0044	0-1	9
PPDDE[1/]	0.73	0-1	9	0.73	0-1	9
PPDDT[2/]	0.32	0-1	9	0.32	0-1	9
Dieldrin	0.059	0-1	9	0.059	0-1	9
Endrin	0.013	0-1	9	0.013	0-1	9
Methylene chloride	2	4-5	7	2	4-5	7
1,1,2,2-Tetrachloroethane[3/]	2.0	0-1	2	2.0	0-1	2
Arsenic	14	0-1	3	--	--	--
Mercury	0.13	0-1	7	--	--	--

1/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
2/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane
3/ Nontarget contaminant. Refer to the exposure assessment nontarget screen in Appendix A.

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

TABLE SSA-2c-2

GROUNDWATER CONTAMINANT CONCENTRATIONS (UG/L)
FOR SITE SSA-2c

AVERAGE SITE DEPTH TO GROUNDWATER: 25 Feet

CHEMICAL	CONCENTRATION MAXIMUM	LOCATION (WELL NUMBER)	SAMPLE DATE
ALDRIN	0.066	03005	12/22/87
CHLOROFORM	5.1	03005	10/27/88
CHLOROBENZENE	3.0	03005	12/22/87
DICYCLOPENTADIENE	19	03005	12/22/87
DIELDRIN	5.0	03005	10/27/88
ENDRIN	0.051	03005	10/27/88
MALATHION	2.4	03005	10/27/88
PARATHION	1.8	03005	10/27/88

EACH VALUE PRESENTED IS THE MAXIMUM CONCENTRATION FOR THE LISTED ANALYTE FOR THE PERIOD March 17, 1987 TO February 28, 1989.
DATA SOURCE: DP ASSOCIATES, RMA Database, July 19, 1990

SSA-2c-3

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPW
ALDRIN	1.5E+00	6.6E+04	1.5E+00	2.9E-03	6.7E-08	2.9E-03	1.7E-07
CHLOROFORM	4.0E+03	0.0E+00	4.0E+03	0.0E+00	0.0E+00	0.0E+00	2.4E-06
CHLOROBENZENE	1.6E+05	0.0E+00	1.6E+05	0.0E+00	0.0E+00	0.0E+00	8.0E-08
DICYCLOPENTADIENE	5.4E+04	0.0E+00	5.4E+04	0.0E+00	0.0E+00	0.0E+00	1.8E-04
PPDDE	7.4E+01	4.0E+06	7.4E+01	9.9E-03	1.8E-07	9.9E-03	0.0E+00
PPDDT	7.4E+01	8.4E+06	7.4E+01	4.3E-03	3.8E-08	4.3E-03	0.0E+00
DIELDRIN	1.6E+00	3.0E+04	1.6E+00	3.7E-02	2.0E-06	3.8E-02	3.6E-07
ENDRIN	2.5E+03	2.4E+07	2.5E+03	5.2E-06	5.3E-10	5.2E-06	8.8E-12
MALATHION	1.7E+05	0.0E+00	1.7E+05	0.0E+00	0.0E+00	0.0E+00	3.4E-13
METHYLENE CHLORIDE	3.3E+03	1.6E+03	1.1E+03	6.1E-04	1.3E-03	1.9F-03	0.0E+00
PARATHION	5.0E+04	0.0E+00	5.0E+04	0.0E+00	0.0E+00	0.0E+00	6.0E-12
1,1,2,2-TETRACHLOROETHANE	1.3E+02	4.5E+02	9.9E+01	1.6E-02	4.4E-03	2.0E-02	0.0E+00
ARSENIC	2.2E+01	0.0E+00	2.2E+01	6.5E-01*	0.0E+00	6.5E-01*	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	3.9E-05	0.0E+00	3.9E-05	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2c-4

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	6.6E+04	1.5E+00	2.9E-03	6.7E-08	2.9E-03	1.7E-07
CHLOROFORM	4.0E+03	0.0E+00	4.0E+03	0.0E+00	0.0E+00	0.0E+00	2.4E-06
CHLOROBENZENE	1.6E+05	0.0E+00	1.6E+05	0.0E+00	0.0E+00	0.0E+00	8.0E-08
DICYCLOPENTADIENE	5.4E+04	0.0E+00	5.4E+04	0.0E+00	0.0E+00	0.0E+00	1.8E-04
PPDDE	7.4E+01	4.0E+06	7.4E+01	9.9E-03	1.8E-07	9.9E-03	0.0E+00
PPDDT	7.4E+01	8.4E+06	7.4E+01	4.3E-03	3.8E-08	4.3E-03	0.0E+00
DIELDRIN	1.6E+00	3.0E+04	1.6E+00	3.7E-02	2.0E-06	3.8E-02	3.6E-07
ENDRIN	2.5E+03	2.4E+07	2.5E+03	5.2E-06	5.3E-10	5.2E-06	8.8E-12
MALATHION	1.7E+05	0.0E+00	1.7E+05	0.0E+00	0.0E+00	0.0E+00	3.4E-13
METHYLENE CHLORIDE	3.3E+03	1.6E+03	1.1E+03	6.1E-04	1.3E-03	1.9E-03	0.0E+00
PARATHION	5.0E+04	0.0E+00	5.0E+04	0.0E+00	0.0E+00	0.0E+00	6.0E-12
1,1,2,2-TETRACHLOROETHANE	1.3E+02	4.5E+02	9.9E+01	1.6E-02	4.4E-03	2.0E-02	0.0E+00
ARSENIC	2.2E+01	0.0E+00	2.2E+01	6.5E-01*	0.0E+00	6.5E-01*	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	3.9E-05	0.0E+00	3.9E-05	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2c-5

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	4.4E+03	2.1E-01	2.1E-02	1.0E-06	2.1E-02	2.5E-06
CHLOROFORM	5.6E+02	0.0E+00	5.6E+02	0.0E+00	0.0E+00	0.0E+00	3.6E-05
CHLOROBENZENE	6.8E+04	0.0E+00	6.8E+04	0.0E+00	0.0E+00	0.0E+00	5.2E-07
DICYCLOPENTADIENE	1.8E+04	0.0E+00	1.8E+04	0.0E+00	0.0E+00	0.0E+00	1.2E-03
PPDDE	1.0E+01	2.6E+05	1.0E+01	7.2E-02	2.8E-06	7.2E-02	0.0E+00
PPDDT	1.0E+01	5.6E+05	1.0E+01	3.1E-02	5.8E-07	3.1E-02	0.0E+00
DIELDRIN	2.2E-01	2.0E+03	2.2E-01	2.7E-01*	3.0E-05	2.7E-01*	5.4E-06
ENDRIN	1.1E+03	3.8E+06	1.1E+03	1.2E-05	3.5E-09	1.2E-05	5.7E-11
MALATHION	7.0E+04	0.0E+00	7.0E+04	0.0E+00	0.0E+00	0.0E+00	2.2E-12
METHYLENE CHLORIDE	4.5E+02	2.4E+02	1.6E+02	4.4E-03	8.2E-03	1.3E-02	0.0E+00
PARATHION	2.1E+04	0.0E+00	2.1E+04	0.0E+00	0.0E+00	0.0E+00	3.9E-11
1,1,2,2-TETRACHLOROETHANE	1.8E+01	3.0E+01	1.1E+01	1.1E-01*	6.6E-02	1.8E-01*	0.0E+00
ARSENIC	3.9E+00	0.0E+00	3.9E+00	3.5E+00*	0.0E+00	3.5E+00*	0.0E+00
MERCURY	2.0E+03	0.0E+00	2.0E+03	6.6E-05	0.0E+00	6.6E-05	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-2c-6

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI EMC
ALDRIN	1.9E+00	4.0E-01	3.3E-01	2.3E-03	1.1E-02	1.3E-02	1.4E-04
CHLOROFORM	5.1E+03	0.0E+00	5.1E+03	0.0E+00	0.0E+00	0.0E+00	2.0E-03
CHLOROBENZENE	8.8E+04	0.0E+00	8.8E+04	0.0E+00	0.0E+00	0.0E+00	2.0E-04
DICYCLOPENTADIENE	1.7E+04	0.0E+00	1.7E+04	0.0E+00	0.0E+00	0.0E+00	4.6E-01
PPDDE	9.3E+01	1.9E+01	1.6E+01	7.8E-03	3.8E-02	4.5E-02	0.0E+00
PPDDT	9.3E+01	1.9E+01	1.6E+01	3.4E-03	1.6E-02	2.0E-02	0.0E+00
DIELDRIN	2.0E+00	5.8E+01	1.9E+00	7.0E-02	1.0E-03	3.1E-02	3.0E-04
ENDRIN	1.4E+03	2.9E+02	2.4E+02	9.5E-06	4.5E-05	5.5E-05	2.2E-08
MALATHION	9.2E+04	0.0E+00	9.2E+04	0.0E+00	0.0E+00	0.0E+00	8.6E-10
METHYLENE CHLORIDE	4.1E+03	1.4E+00	1.4E+00	4.9E-04	1.5E+00*	1.5E+00*	0.0E+00
PARATHION	2.7E+04	0.0E+00	2.7E+04	0.0E+00	0.0E+00	0.0E+00	1.5E-08
1,1,2,2-TETRACHLOROETHANE	1.6E+02	8.7E-01	8.7E-01	1.2E-02	2.3E+00*	2.3E+00*	0.0E+00
ARSENIC	2.0E+01	0.0E+00	2.0E+01	7.0E-01*	0.0E+00	7.0E-01*	0.0E+00
MERCURY	1.4E+03	0.0E+00	1.4E+03	9.3E-05	0.0E+00	9.3E-05	0.0E+00

*: EI is equal to or exceeds 1.0E-01

SSA-2c-7

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	8.8E+03	4.0E-01	9.0E-02	3.8E-02	1.1E-02	4.9E-02	1.3E-06	4.3E-04
CHLOROFORM	3.1E+02	0.0E+00	0.0E+00	3.1E+02	0.0E+00	0.0E+00	0.0E+00	1.8E-05	6.0E-03
CHLOROBENZENE	1.5E+04	0.0E+00	0.0E+00	1.5E+04	0.0E+00	0.0E+00	0.0E+00	6.0E-07	2.0E-04
DICYCLOPENTADIENE	1.2E+03	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00	1.4E-03	4.6E-01
PPDDE	5.7E+00	5.3E+05	1.9E+01	4.4E+00	1.3E-01*	3.8E-02	1.7E-01*	0.0E+00	0.0E+00
PPDDT	5.7E+00	1.1E+06	1.9E+01	4.4E+00	5.6E-02	1.6E-02	7.2E-02	0.0E+00	0.0E+00
DIELDRIN	1.2E-01	4.0E+03	1.9E+01	1.2E-01	4.8E-01*	3.1E-03	4.9E-01*	2.7E-06	9.0E-04
ENDRIN	2.5E+02	3.2E+06	8.6E+02	2.0E+02	5.1E-05	1.5E-05	6.6E-05	6.6E-11	2.2E-08
MALATHION	1.7E+04	0.0E+00	0.0E+00	1.7E+04	0.0E+00	0.0E+00	0.0E+00	2.6E-12	8.6E-10
METHYLENE CHLORIDE	2.5E+02	2.1E+02	1.4E+00	1.3E+00	8.1E-03	1.5E+00*	1.5E+00*	0.0E+00	0.0E+00
PARATHION	5.1E+03	0.0E+00	0.0E+00	5.1E+03	0.0E+00	0.0E+00	0.0E+00	4.5E-11	1.5E-08
1,1,2,2-TETRACHLOROETHANE	9.9E+00	6.1E+01	2.9E-01	2.8E-01	2.0E-01*	6.9E+00*	7.1E+00*	0.0E+00	0.0E+00
ARSENIC	1.6E+00	0.0E+00	0.0E+00	1.6E+00	8.7E+00*	0.0E+00	8.7E+00*	0.0E+00	0.0E+00
MERCURY	4.6E+02	0.0E+00	0.0E+00	4.6E+02	2.8E-04	0.0E+00	2.8E-04	0.0E+00	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.10 SITE SSA-3a: BURIED LAKE SLUDGE (formerly Site 11-1: Buried Lake Sludge; EBASCO, 1987h/RIC 87196R04 and EBASCO, 1988i/RIC 87196R04A)

2.10.1 Site-Specific Considerations

Figure SSA-3a-1 and Table SSA-3a-1 depict the target contaminants for Site SSA-3a. Borings 1 through 21 were included in the exposure assessment, consistent with the Southern SAR. The historical search conducted under the contamination assessment revealed that lake sludges contaminated with Aldrin, Dieldrin, and Endrin were disposed of in Site SSA-3a. However, the Phase I investigation did not detect any of these chemicals, and in the Phase II investigation only selected borings were analyzed. According to site history, no other chemicals from the RMA target contaminant list were suspected to be present in Site SSA-3a (EBASCO, 1987h/RIC 87196R04).

2.10.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-3a are shown in Figure SSA-3a-1. Table SSA-3a-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury for Horizon 2 because direct soil exposure below 10 feet is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

Concentrations of Aldrin, Dieldrin, and Endrin are also listed in Table SSA-3a-1, although they were not detected in the soil investigations. The maximum values presented, which are equivalent to the Phase I CRL, are used in this analysis in order to assess the possible impact of these suspected contaminants (see Section 2.10.1) where analytical data were not available.

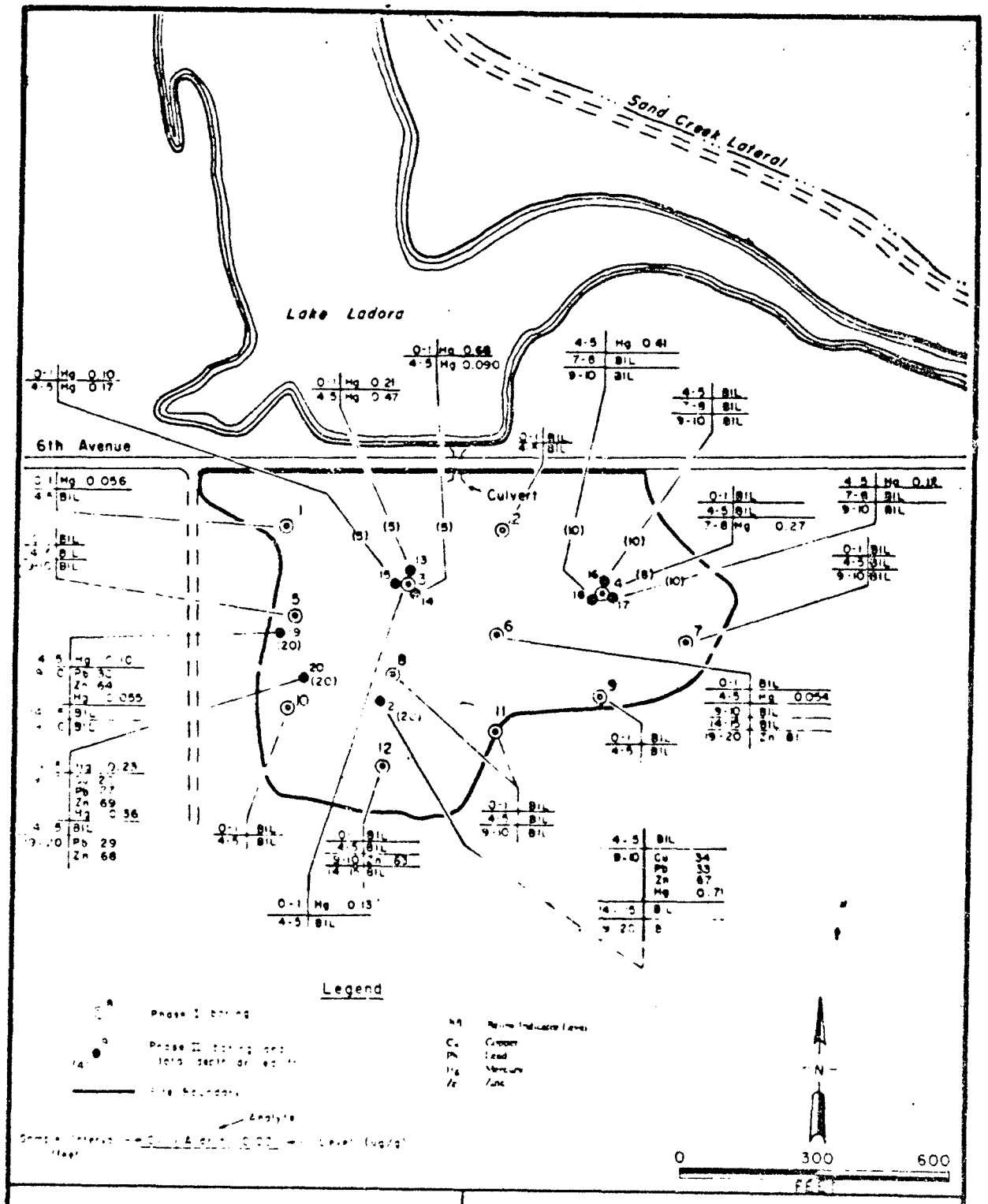
2.10.3 Site Exposure Summary

Tables SSA-3a-2 through SSA-3a-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Aldrin	Direct	Direct	Direct	Direct	Direct
Dieldrin	Direct	Direct	Direct	Direct	Direct

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.

The results of the soil exposure summary indicate that exposure to contamination from the direct pathways are the primary contributors to the exceedance of the cumulative PPLVs. Site SSA-3a is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-3a-1

Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by Ebasco Services Incorporated

TABLE SSA-3a-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-3a

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Aldrin[1/]	0.30	NA[2/]	NA	0.30	NA	NA
Dieldrin[1/]	0.30	NA	NA	0.30	NA	NA
Endrin[1/]	0.50	NA	NA	0.50	NA	NA
Mercury	0.71	9-10	21	--	--	--

1/ The concentration of this suspected chemical is assumed to be equal to the Phase I detection limit due to the lack of Phase II data.
2/ NA denotes not applicable.

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-3a-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	4.2E+04	1.5E+00	2.0E-01*	7.2E-06	2.0E-01*	0.0E+00
DIELDRIN	1.6E+00	1.9E+04	1.6E+00	1.9E-01*	1.6E-05	1.9E-01*	0.0E+00
ENDRIN	2.5E+03	1.5E+07	2.5E+03	2.0E-04	3.2E-08	2.0E-04	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	2.1E-04	0.0E+00	2.1E-04	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-3a-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	4.2E+04	1.5E+00	2.0E-01*	7.2E-06	2.0E-01*	0.0E+00
DIELDRIN	1.6E+00	1.9E+04	1.6E+00	1.9E-01*	1.6E-05	1.9E-01*	0.0E+00
ENDRIN	2.5E+03	1.5E+07	2.5E+03	2.0E-04	3.2E-08	2.0E-04	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	2.1E-04	0.0E+00	2.1E-04	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-3a-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	2.8E+03	2.1E-01	1.4E+00*	1.1E-04	1.4E+00*	0.0E+00
DIELDRIN	2.2E-01	1.3E+03	2.2E-01	1.4E+00*	2.4E-04	1.4E+00*	0.0E+00
ENDRIN	1.1E+03	2.4E+06	1.1E+03	4.7E-04	2.1E-07	4.7E-04	0.0E+00
MERCURY	2.0E+03	0.0E+00	2.0E+03	3.6E-04	0.0E+00	3.6E-04	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-3a-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	0.0E+00	1.9E+00	1.6E-01*	0.0E+00	1.6E-01*	NA
DIELDRIN	2.0E+00	0.0E+00	2.0E+00	1.5E-01*	0.0E+00	1.5E-01*	NA
ENDRIN	1.4E+03	0.0E+00	1.4E+03	3.6E-04	0.0E+00	3.6E-04	NA
MERCURY	1.4E+03	0.0E+00	1.4E+03	5.1E-04	0.0E+00	5.1E-04	NA

*: EI is equal to or exceeds 1.0E-01

SSA-3a-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	5.6E+03	0.0E+00	1.2E-01	2.6E+00*	5.4E-05	2.6E+00*	0.0E+00	NA
DIELDRIN	1.2E-01	2.5E+03	0.0E+00	1.2E-01	2.5E+00*	1.2E-04	2.5E+00*	0.0E+00	NA
ENDRIN	2.5E+02	2.1E+06	0.0E+00	2.5E+02	2.0E-03	2.4E-07	2.0E-03	0.0E+00	NA
MERCURY	4.6E+02	0.0E+00	0.0E+00	4.6E+02	1.5E-03	0.0E+00	1.5E-03	0.0E+00	NA

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.11 SITE SSA-3b: BURIED LAKE SLUDGE (formerly Site 12-1: Buried Lake Sludge; EBASCO, 1987i/RIC 88096R01 and EBASCO, 1988j/RIC 88096R01A)

2.11.1 Site-Specific Considerations

Figure SSA-3b-1 and Table SSA-3b-1 depict the target contaminants for Site SSA-3b. Borings 1 through 23 were included in the exposure assessment, consistent with the Southern SAR. A previous soil investigation detected widespread concentrations of chromium, copper, lead, and zinc in Site SSA-3b (EBASCO, 1987i/RIC 88096R01); however, these chemicals were not detected during the Phase I and Phase II investigations. According to the site history, no other chemicals from the RMA target contaminant list were suspected to be present in Site SSA-3b (EBASCO, 1987i/RIC 88096R01).

2.11.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site-3b are shown in Figure SSA-3b-1. Table SSA-3b-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

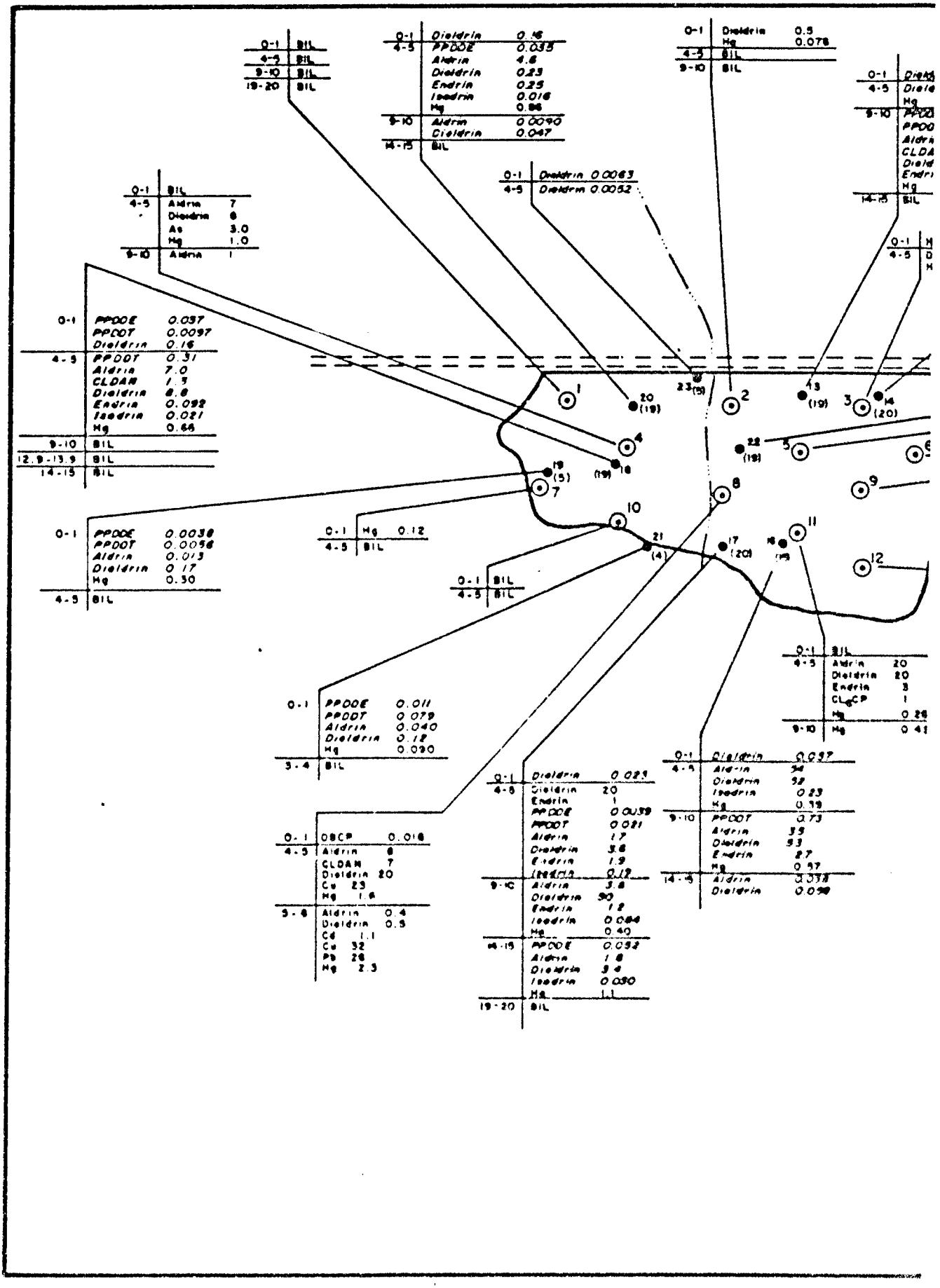
2.11.3 Site Exposure Summary

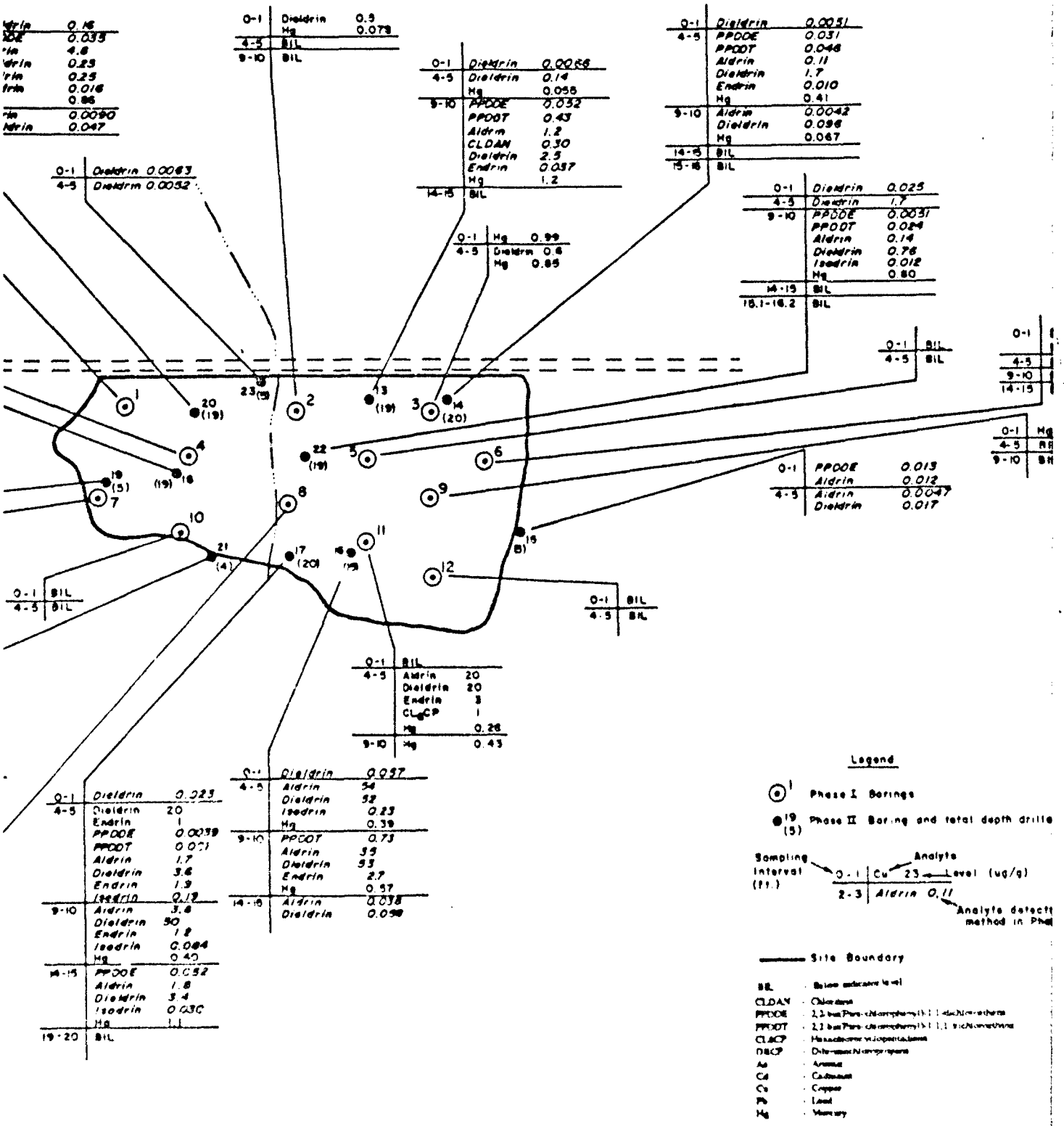
Tables SSA-3b-2 through SSA-3b-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Aldrin	Direct	Direct	Direct	Dir/Ind	Dir/Ind
Chlordane	Direct	Direct	Direct	Direct	Direct
Dieldrin	Direct	Direct	Direct	Dir/Ind	Dir/Ind
Hexachlorocyclo-pendtadiene	--	--	--	Indirect	Indirect
PPDDT	--	--	--	--	Direct

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

The results of the soil exposure summary indicate that exposure to contamination from the direct and indirect pathways both contribute to the exceedance of the cumulative PPLVs. Site SSA-3b is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).


0-1 BIL
4-5 BIL
9-10 BIL
19-20 BIL
0-1 Dieldrin 0.16
4-5 PPDDE 0.035
Aldrin 4.6
Dieldrin 0.23
Endrin 0.25
Isodrin 0.016
Hg 0.86
9-10 Aldrin 0.0090
Dieldrin 0.047
14-15 BIL
0-1 Dieldrin 0.5
Hg 0.078
4-5 BIL
9-10 BIL
0-1 Dieldrin 0.0063
4-5 Dieldrin 0.0052
0-1 BIL
4-5 Aldrin 7
Dieldrin 6
As 3.0
Hg 1.0
9-10 Aldrin 1
0-1 PPDDE 0.097
PPDDT 0.0097
Dieldrin 0.16
4-5 PPDDT 0.31
Aldrin 7.0
CLDAN 1.5
Dieldrin 6.8
Endrin 0.092
Isodrin 0.021
Hg 0.66
9-10 BIL
12.9-13.9 BIL
14-15 BIL
0-1 PPDDE 0.0038
PPDDT 0.0056
Aldrin 0.013
Dieldrin 0.17
Hg 0.30
4-5 BIL
0-1 Hg 0.12
4-5 BIL
0-1 BIL
4-5 BIL
0-1 PPDDE 0.011
PPDDT 0.079
Aldrin 0.040
Dieldrin 0.18
Hg 0.090
3-4 BIL
0-1 OBCP 0.018
4-5 Aldrin 8
CLDAN 7
Dieldrin 20
Cu 23
Hg 1.6
5-8 Aldrin 0.4
Dieldrin 0.5
Cd 1.1
Cu 32
Pb 28
Hg 2.3
0-1 Dieldrin 0.029
4-8 Dieldrin 20
Endrin 1
PPDDE 0.0059
PPDDT 0.021
Aldrin 1.7
Dieldrin 3.6
Endrin 1.9
Isodrin 0.12
9-10 Aldrin 3.8
Dieldrin 90
Endrin 1.2
Isodrin 0.084
Hg 0.40
14-15 PPDDE 0.052
Aldrin 1.8
Dieldrin 3.4
Isodrin 0.030
Hg 1.1
19-20 BIL
0-1 Dieldrin 0.097
4-5 Aldrin 34
Dieldrin 52
Isodrin 0.23
Hg 0.99
9-10 PPDDT 0.73
Aldrin 33
Dieldrin 53
Endrin 2.7
Hg 0.97
14-15 Aldrin 0.038
Dieldrin 0.058
0-1 BIL
4-5 Aldrin 20
Dieldrin 20
Endrin 3
CL6CP 1
Hg 0.28
9-10 Hg 0.41
1
2
3
4
5
6
7
8
9
10
11
12
20 (19)
23 (19)
13 (19)
14 (20)
22 (19)
19 (5)
18 (19)
21 (4)
17 (20)
16 (19)



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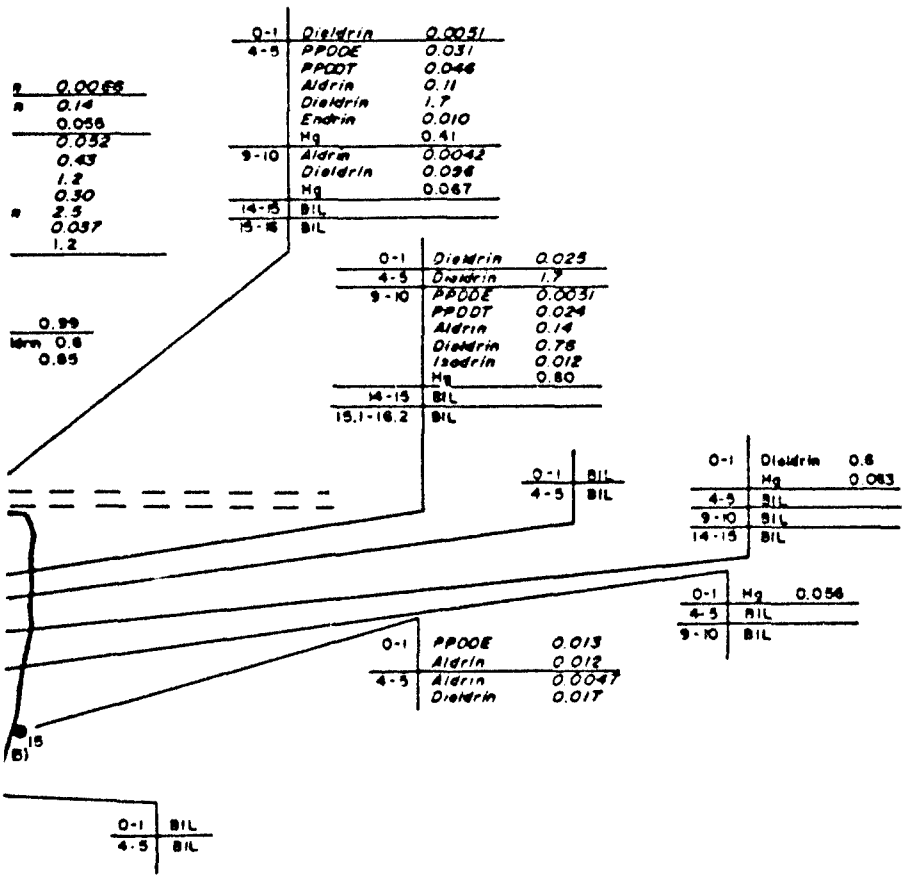
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland



Legend

Phase I Borings

Phase II Boring and total depth drilled(ft)

Sampling Interval (ft) — Analyte — Level (ug/g)

0-1 | Cu 23

2-3 | Aldrin 0.11

Analyte detected by different method in Phase II - see text

Site Boundary

BIL - Below indicator level

CLDAN - Chlordane

PPDDE - 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene

PPDDT - 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane

CLHCP - Hexachlorocyclopentadiene

DBCP - Dibromochloropropane

As - Arsenic

Cd - Cadmium

Cu - Copper

Pb - Lead

Hg - Mercury

N

0 300 600

FEET

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-3b-1
Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

TABLE SSA-3b-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-3b

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Aldrin	54	4-5	16	54	4-5	16
Chlordane	7	4-5	8	7	4-5	8
PPDDE[1/]	0.052	9-10	13	0.052	9-10	13
	--	--	--		14-15	17
PPDDT[2/]	0.73	9-10	16	0.73	9-10	16
Dibromochloropropane	0.018	0-1	8	0.018	0-1	8
Dieldrin	53	9-10	16	53	9-10	16
Endrin	3	4-5	11	3	4-5	11
Hexachlorocyclopentadiene	1	4-5	11	1	4-5	11
Isodrin	0.23	4-5	16	0.23	4-5	16
Mercury	2.3	5-6	8	--	--	--

1/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
2/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-3b-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	6.4E+04	1.5E+00	3.6E+01*	8.4E-04	3.6E+01*	0.0E+00
CHLORDANE	2.0E+01	2.7E+08	2.0E+01	3.6E-01*	2.6E-08	3.6E-01*	0.0E+00
PPDDE	7.4E+01	3.9E+06	7.4E+01	7.1E-04	1.3E-08	7.1E-04	0.0E+00
PPDDT	7.4E+01	8.2E+06	7.4E+01	9.9E-03	8.9E-08	9.9E-03	0.0E+00
DIBROMOCHLOROPROPANE	1.8E+01	9.7E+01	1.5E+01	1.0E-03	1.8E-04	1.2E-03	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	3.4E+01*	1.8E-03a	3.4E+01*	0.0E+00
ENDRIN	2.5E+03	1.0E+06	2.5E+03	1.2E-03	5.7E-09a	1.2E-03	0.0E+00
HEXACHLOROCYCLOPENTADIENE	1.7E+04	6.6E+02	6.3E+02	6.0E-05	1.5E-03	1.6E-03	0.0E+00
ISODRIN	5.8E+02	2.3E+07	5.8E+02	4.0E-04	9.8E-09	4.0E-04	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	7.0E-04	0.0E+00	7.0E-04	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-3b-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	6.4E+04	1.5E+00	3.6E+01*	8.4E-04	3.6E+01*	0.0E+00
CHLORDANE	2.0E+01	2.7E+08	2.0E+01	3.6E-01*	2.6E-08	3.6E-01*	0.0E+00
PPDDE	7.4E+01	3.9E+06	7.4E+01	7.1E-04	1.3E-08	7.1E-04	0.0E+00
PPDDT	7.4E+01	8.2E+06	7.4E+01	9.9E-03	8.9E-08	9.9E-03	0.0E+00
DIBROMOCHLOROPROPANE	1.8E+01	9.7E+01	1.5E+01	1.0E-03	1.8E-04	1.2E-03	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	3.4E+01*	1.8E-03a	3.4E+01*	0.0E+00
ENDRIN	2.5E+03	1.0E+06	2.5E+03	1.2E-03	5.7E-09a	1.2E-03	0.0E+00
HEXACHLOROCYCLOPENTADIENE	1.7E+04	6.6E+02	6.3E+02	6.0E-05	1.5E-03	1.6E-03	0.0E+00
ISODRIN	5.8E+02	2.3E+07	5.8E+02	4.0E-04	9.8E-09	4.0E-04	0.0E+00
MERCURY	3.3E+03	0.0E+00	3.3E+03	7.0E-04	0.0E+00	7.0E-04	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-3b-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	4.3E+03	2.1E-01	2.6E+02*	1.3E-02	2.6E+02*	0.0E+00
CHLORDANE	2.7E+00	1.8E+07	2.7E+00	2.6E+00*	3.9E-07	2.6E+00*	0.0E+00
PPDDE	1.0E+01	2.6E+05	1.0E+01	5.1E-03	2.0E-07	5.1E-03	0.0E+00
PPDDT	1.0E+01	5.4E+05	1.0E+01	7.2E-02	1.3E-06	7.2E-02	0.0E+00
DIBROMOCHLOROPROPANE	2.5E+00	1.5E+01	2.1E+00	7.2E-03	1.2E-03	8.4E-03	0.0E+00
DIELDRIN	2.2E-01	1.0E+06	2.2E-01	2.4E+02*	2.7E-02a	2.4E+02*	0.0E+00
ENDRIN	1.1E+03	1.0E+06	1.1E+03	2.8E-03	3.7E-08a	2.8E-03	0.0E+00
HEXACHLOROCYCLOPENTADIENE	5.7E+03	2.4E+02	2.3E+02	1.8E-04	4.2E-03	4.4E-03	0.0E+00
ISODRIN	2.5E+02	3.6E+06	2.5E+02	9.3E-04	6.3E-08	9.3E-04	0.0E+00
MERCURY	2.0E+03	0.0E+00	2.0E+03	1.2E-03	0.0E+00	1.2E-03	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-3b-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	1.3E+02	1.9E+00	2.9E+01*	4.3E-01*	2.9E+01*	0.0E+00
CHLORDANE	2.5E+01	1.4E+04	2.5E+01	2.8E-01*	5.2E-04	2.8E-01*	0.0E+00
PPDDE	9.3E+01	7.6E+03	9.2E+01	5.6E-04	6.8E-06	5.7E-04	0.0E+00
PPDDT	9.3E+01	1.6E+04	9.2E+01	7.8E-03	4.5E-05	7.9E-03	0.0E+00
DIBROMOCHLOROPROPANE	2.3E+01	4.8E+00	3.9E+00	7.9E-04	3.8E-03	4.6E-03	0.0E+00
DIELDRIN	2.0E+00	5.8E+01	1.9E+00	2.7E+01*	9.2E-01*	2.8E+01*	0.0E+00
ENDRIN	1.4E+03	1.0E+06	1.3E+03	2.2E-03	1.9E-04a	2.4E-03	0.0E+00
HEXACHLOROCYCLOPENTADIENE	5.5E+03	2.1E+00	2.1E+00	1.8E-04	4.7E-01*	4.7E-01*	0.0E+00
ISODRIN	3.2E+02	3.0E+03	2.9E+02	7.2E-04	7.6E-05	7.9E-04	0.0E+00
MERCURY	1.4E+03	0.0E+00	1.4E+03	1.7E-03	0.0E+00	1.7E-03	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

SSA-3b-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	8.6E+03	4.2E+01	1.2E-01	4.6E+02*	1.3E+00*	4.7E+02*	0.0E+00	0.0E+00
CHLORDANE	1.5E+00	3.6E+07	4.5E+03	1.5E+00	4.6E+00*	1.5E-03	4.6E+00*	0.0E+00	0.0E+00
PPDDE	5.7E+00	5.2E+05	2.5E+03	5.7E+00	9.1E-03	2.1E-05	9.1E-03	0.0E+00	0.0E+00
PPDDT	5.7E+00	1.1E+06	5.4E+03	5.7E+00	1.3E-01*	1.4E-04	1.3E-01*	0.0E+00	0.0E+00
DIBROMOCHLOROPROPANE	1.4E+00	1.3E+01	4.8E+00	1.0E+00	1.3E-02	5.2E-03	1.8E-02	0.0E+00	0.0E+00
DIELDRIN	1.2E-01	3.9E+03	1.9E+01	1.2E-01	4.3E+02*	2.8E+00*	4.4E+02*	0.0E+00	0.0E+00
ENDRIN	2.5E+02	1.0E+06	1.0E+06	2.5E+02	1.2E-02	1.9E-04a	1.2E-02	0.0E+00	0.0E+00
HEXACHLOROCYCLOPENTADIENE	3.8E+02	8.8E+01	6.4E+00	5.9E+00	2.6E-03	1.7E-01*	1.7E-01*	0.0E+00	0.0E+00
ISODRIN	5.9E+01	3.1E+06	3.0E+03	5.8E+01	3.9E-03	7.6E-05	4.0E-03	0.0E+00	0.0E+00
MERCURY	4.6E+02	0.0E+00	0.0E+00	4.6E+02	5.0E-03	0.0E+00	5.0E-03	0.0E+00	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.12 SITE SSA-4: TRASH DUMP (formerly Site 1-12: Trash Dump; EBASCO, 1987j/ RIC 87127R03 and EBASCO, 1988k/RIC 87127R03A)

2.12.1 Site-Specific Considerations

Figure SSA-4-1 and Table SSA-4-1 depict the target contaminants for Site SSA-4. Borings 1 through 14 were included in the exposure assessment, consistent with the Southern SAR. According to site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-4 (EBASCO, 1987j/RIC 87127R03).

2.12.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-4 are shown in Figure SSA-4-1. Table SSA-4-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

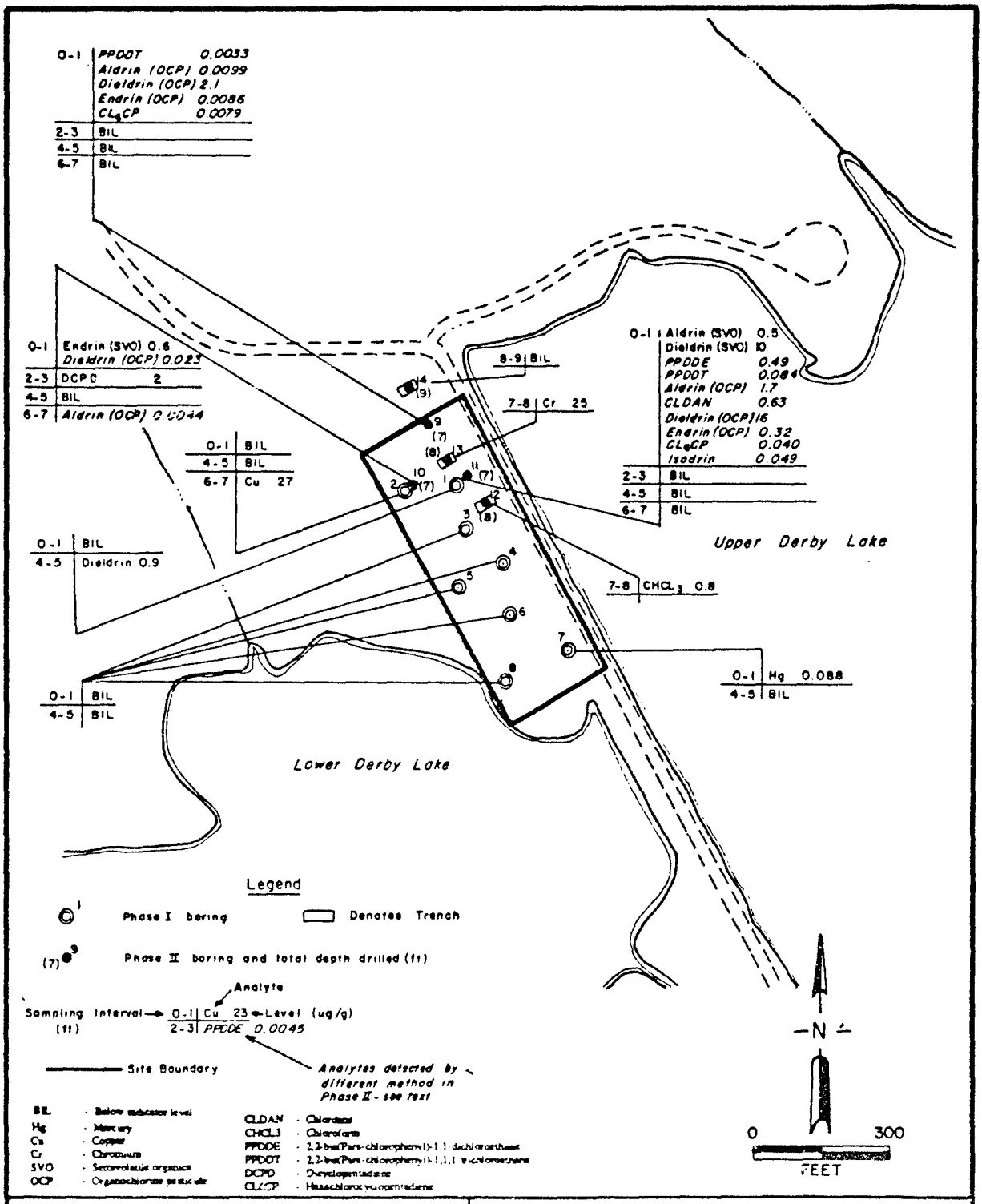
2.12.3 Site Exposure Summary

Tables SSA-4-2 through SSA-4-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Aldrin	Direct	Direct	Direct	Direct	Direct
Dieldrin	Direct	Direct	Direct	Direct	Direct
Chlordane	--	--	Direct	--	Direct

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.

The results of the soil exposure summary indicate that exposure to contamination from the direct pathways are the primary contributors to the exceedance of the cumulative PPLVs. Site SSA-4 is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-4-1

Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

TABLE SSA-4-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-4

Contaminant	Horizon 1			Horizon 2		
	Max. (ug/g)	Depth (ft)	Boring Number	Max. (ug/g)	Depth (ft)	Boring Number
Aldrin	1.7	0-1	11	1.7	0-1	11
Chlordane	0.63	0-1	11	0.63	0-1	11
Chloroform	0.8	7-8	12	0.8	7-8	12
PPDDE[1/]	0.49	0-1	11	0.49	0-1	11
PPDDT[2/]	0.084	0-1	11	0.084	0-1	11
Dicyclopentadiene	2	2-3	10	2	2-3	10
Dieldrin	16	0-1	11	16	0-1	11
Endrin	0.6	0-1	10	0.6	0-1	10
Hexachlorocyclopentadiene	0.040	0-1	11	0.040	0-1	11
Isodrin	0.049	0-1	11	0.049	0-1	11

1/ PPDDE 2,2-bis(Para-chlorophenyl)-1,1-dichloroethene
2/ PPDDT 2,2-bis(Para-chlorophenyl)-1,1,1-trichloroethane

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-4-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI CPM
ALDRIN	1.5E+00	1.4E+05	1.5E+00	1.1E+00*	1.2E-05	1.1E+00*	0.0E+00
CHLORDANE	2.0E+01	1.5E+07	2.0E+01	3.2E-02	4.2E-08	3.2E-02	0.0E+00
CHLOROFORM	4.0E+03	1.1E+04	3.0E+03	2.0E-04	7.2E-05	2.7E-04	0.0E+00
PPDDE	7.4E+01	8.5E+06	7.4E+01	6.7E-03	5.8E-08	6.7E-03	0.0E+00
PPDDT	7.4E+01	1.8E+07	7.4E+01	1.1E-03	4.7E-09	1.1E-03	0.0E+00
DICYCLOPENTADIENE	5.4E+04	9.5E+03	8.1E+03	3.7E-05	2.1E-04	2.5E-04	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	1.0E+01*	2.5E-04a	1.0E+01*	0.0E+00
ENDRIN	2.5E+03	5.2E+07	2.5E+03	2.4E-04	1.2E-08	2.4E-04	0.0E+00
HEXACHLOROCYCLOPENTADIENE	1.7E+04	4.3E+03	3.4E+03	2.4E-06	9.3E-06	1.2E-05	0.0E+00
ISODRIN	5.8E+02	1.0E+07	5.8E+02	8.5E-05	4.8E-09	8.5E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

f the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant oes not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-4-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	1.5E+00	1.4E+05	1.5E+00	1.1E+00*	1.2E-05	1.1E+00*	0.0E+00
CHLORDANE	2.0E+01	1.5E+07	2.0E+01	3.2E-02	4.2E-08	3.2E-02	0.0E+00
CHLOROFORM	4.0E+03	1.1E+04	3.0E+03	2.0E-04	7.2E-05	2.7E-04	0.0E+00
PPDDE	7.4E+01	8.5E+06	7.4E+01	6.7E-03	5.8E-08	6.7E-03	0.0E+00
PPDDT	7.4E+01	1.8E+07	7.4E+01	1.1E-03	4.7E-09	1.1E-03	0.0E+00
DICYCLOPENTADIENE	5.4E+04	9.5E+03	8.1E+03	3.7E-05	2.1E-04	2.5E-04	0.0E+00
DIELDRIN	1.6E+00	1.0E+06	1.6E+00	1.0E+01*	2.5E-04a	1.0E+01*	0.0E+00
ENDRIN	2.5E+03	5.2E+07	2.5E+03	2.4E-04	1.2E-08	2.4E-04	0.0E+00
HEXACHLOROCYCLOPENTADIENE	1.7E+04	4.3E+03	3.4E+03	2.4E-06	9.3E-06	1.2E-05	0.0E+00
ISODRIN	5.8E+02	1.0E+07	5.8E+02	8.5E-05	4.8E-09	8.5E-05	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-4-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
ALDRIN	2.1E-01	9.3E+03	2.1E-01	8.2E+00*	1.8E-04	8.2E+00*	0.0E+00
CHLORDANE	2.7E+00	1.0E+06	2.7E+00	2.3E-01*	6.3E-07	2.3E-01*	0.0E+00
CHLOROFORM	5.6E+02	1.7E+03	4.2E+02	1.4E-03	4.7E-04	1.9E-03	0.0E+00
PPDDE	1.0E+01	5.6E+05	1.0E+01	4.8E-02	8.7E-07	4.8E-02	0.0E+00
PPDDT	1.0E+01	1.2E+06	1.0E+01	8.2E-03	7.1E-08	8.2E-03	0.0E+00
DICYCLOPENTADIENE	1.8E+04	3.4E+03	2.9E+03	1.1E-04	5.8E-04	6.9E-04	0.0E+00
DIELDRIN	2.2E-01	1.0E+06	2.2E-01	7.3E+01*	3.8E-03a	7.3E+01*	0.0E+00
ENDRIN	1.1E+03	8.0E+06	1.1E+03	5.7E-04	7.5E-08	5.7E-04	0.0E+00
HEXACHLOROCYCLOPENTADIENE	5.7E+03	1.5E+03	1.2E+03	7.1E-06	2.6E-05	3.3E-05	0.0E+00
ISODRIN	2.5E+02	1.6E+06	2.5E+02	2.0E-04	3.1E-08	2.0E-04	0.0E+00

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-4-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
ALDRIN	1.9E+00	0.0E+00	1.9E+00	9.0E-01*	0.0E+00	9.0E-01*	NA
CHLORDANE	2.5E+01	0.0E+00	2.5E+01	2.6E-02	0.0E+00	2.6E-02	NA
CHLOROFORM	5.1E+03	0.0E+00	5.1E+03	1.6E-04	0.0E+00	1.6E-04	NA
PPDDE	9.3E+01	0.0E+00	9.3E+01	5.3E-03	0.0E+00	5.3E-03	NA
PPDDT	9.3E+01	0.0E+00	9.3E+01	9.0E-04	0.0E+00	9.0E-04	NA
DICYCLOPENTADIENE	1.7E+04	0.0E+00	1.7E+04	1.2E-04	0.0E+00	1.2E-04	NA
DIELDRIN	2.0E+00	0.0E+00	2.0E+00	8.0E+00*	0.0E+00	8.0E+00*	NA
ENDRIN	1.4E+03	0.0E+00	1.4E+03	4.4E-04	0.0E+00	4.4E-04	NA
HEXACHLOROCYCLOPENTADIENE	5.5E+03	0.0E+00	5.5E+03	7.3E-06	0.0E+00	7.3E-06	NA
ISODRIN	3.2E+02	0.0E+00	3.2E+02	1.5E-04	0.0E+00	1.5E-04	NA

*: EI is equal to or exceeds 1.0E-01

SSA-4-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE SPPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
ALDRIN	1.2E-01	1.9E+04	0.0E+00	1.2E-01	1.5E+01*	9.1E-05	1.5E+01*	0.0E+00	NA
CHLORDANE	1.5E+00	2.0E+06	0.0E+00	1.5E+00	4.1E-01*	3.1E-07	4.1E-01*	0.0E+00	NA
CHLOROFORM	3.1E+02	1.5E+03	0.0E+00	2.6E+02	2.6E-03	5.4E-04	3.1E-03	0.0E+00	NA
PPDDE	5.7E+00	1.1E+06	0.0E+00	5.7E+00	8.6E-02	4.3E-07	8.6E-02	0.0E+00	NA
PPDDT	5.7E+00	2.4E+06	0.0E+00	5.7E+00	1.5E-02	3.5E-08	1.5E-02	0.0E+00	NA
DICYCLOPENTADIENE	1.2E+03	1.3E+03	0.0E+00	6.1E+02	1.7E-03	1.6E-03	3.3E-03	0.0E+00	NA
DIELDRIN	1.2E-01	1.0E+06	1.0E+06	1.2E-01	1.3E+02*	1.9E-03a	1.3E+02*	0.0E+00	NA
ENDRIN	2.5E+02	6.9E+06	0.0E+00	2.5E+02	2.4E-03	8.7E-08	2.4E-03	0.0E+00	NA
HEXACHLOROCYCLOPENTADIENE	3.8E+02	5.7E+02	0.0E+00	2.3E+02	1.0E-04	7.0E-05	1.7E-04	0.0E+00	NA
ISODRIN	5.9E+01	1.4E+06	0.0E+00	5.9E+01	8.3E-04	3.6E-08	8.3E-04	0.0E+00	NA

a: This contaminant saturates the soil gas and produces a vapor flux which is below one-tenth of the critical flux. The SPPPLV for this contaminant is considered to be equal to pure compound. The SPPPLV has therefore been set to 1.00E+06 mg/kg (See volume VI-A).

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.13 SITE SSA-5a: SECTION 1 - DIBROMOCHLOROPROPANE DETECTION (formerly Section 1-Uncontaminated Area; EBASCO; 1987k/RIC 87127R06 and EBASCO, 1988l/ RIC 87127R06A)

2.13.1 Site-Specific Considerations

Figure SSA-5a-1 and Table SSA-5a-1 depict the target contaminants for Site SSA-5a. Borings 17 and 65 through 67 were included in this exposure assessment, consistent with the Southern SAR. According to site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-5a (EBASCO, 1987k/RIC 87127R06).

2.13.2 Spatial Distribution of Measured Contaminant Concentrations

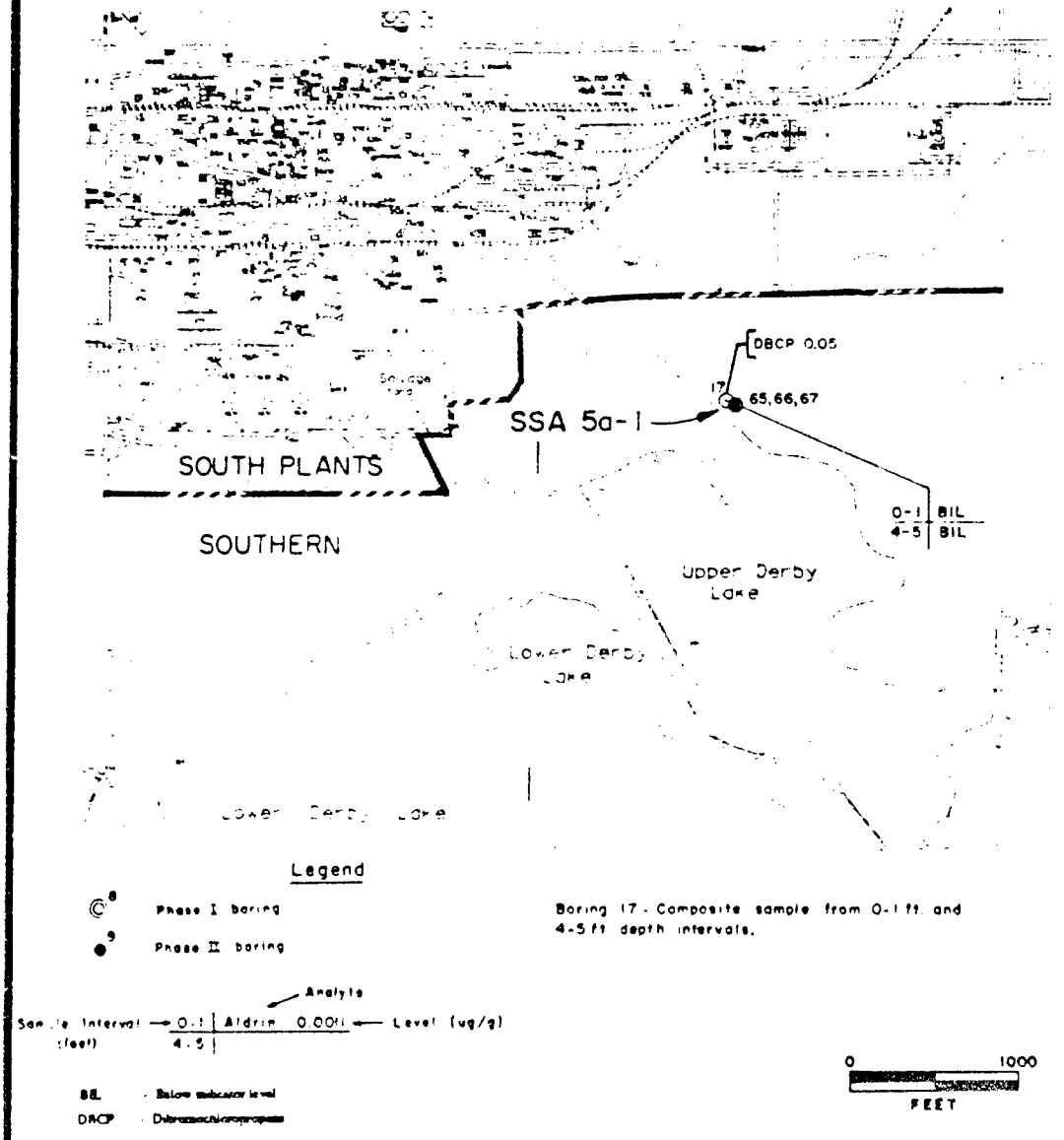
The locations and concentrations of the target contaminants that were detected in site SSA-5a are shown in Figure SSA-5a-1. Table SSA-5a-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

2.13.3 Site Exposure Summary

Tables SSA-5a-2 through SSA-5-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
None	--	--	--	--	--

The results of the soil exposure summary indicate that there are no COCs. Site SSA-5a is designated as a Priority 2 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-5a-1

Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal
Prepared by: Ebasco Services Incorporated

TABLE SSA-5a-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-5a

Contaminant	Horizon 1 Max. (ug/g)	Horizon 1 Depth (ft)	Horizon 1 Boring Number	Horizon 2 Max. (ug/g)	Horizon 2 Depth (ft)	Horizon 2 Boring Number
Dibromochloropropane	0.05	Comp[1/] 0-1, 4-5	17	0.05	Comp 0-1, 4-5	17

1/ Comp Composite sample from 0-1 ft and 4-5 ft depth intervals.

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-5a-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
DIBROMOCHLOROPROPANE	1.8E+01	3.7E+06	1.8E+01	2.8E-03	1.4E-08	2.8E-03	0.0E+00

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-5a-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
DIBROMOCHLOROPROPANE	1.8E+01	3.7E+06	1.8E+01	2.8E-03	1.4E-08	2.8E-03	0.0E+00

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-5a-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
DIBROMOCHLOROPROPANE	2.5E+00	5.7E+05	2.5E+00	2.0E-02	8.8E-08	2.0E-02	0.0E+00

SSA-5a-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
DIBROMOCHLOROPROPANE	2.3E+01	0.0E+00	2.3E+01	2.2E-03	0.0E+00	2.2E-03	NA

SSA-5a-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE FI	VEI OPN	VEI ENC
DIBROMOCHLOROPROPANE	1.4E+00	4.9E+05	0.0E+00	1.4E+00	3.6E-02	1.0E-07	3.6E-02	0.0E+00	NA

2.14 SITE SSA-5b: HAVANA/PEORIA STREETS - PONDS AND DITCHES (formerly Section 11-Uncontaminated Area; EBASCO, 1987l/RIC 87216R10 and EBASCO, 1988m/RIC 87216R10A)

2.14.1 Site-Specific Considerations

Figure SSA-5b-1 and Table SSA-5b-1 depict the target contaminants for Site SSA-5b. Borings 13 through 15, 18 through 20, 23, 24, 29 through 31, and 43 through 54 were included in this exposure assessment, consistent with the Southern SAR. According to site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-5b (EBASCO, 1987l/RIC 87216R10).

2.14.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-5b are shown on Figure SSA-5b-1. Table SSA-5b-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

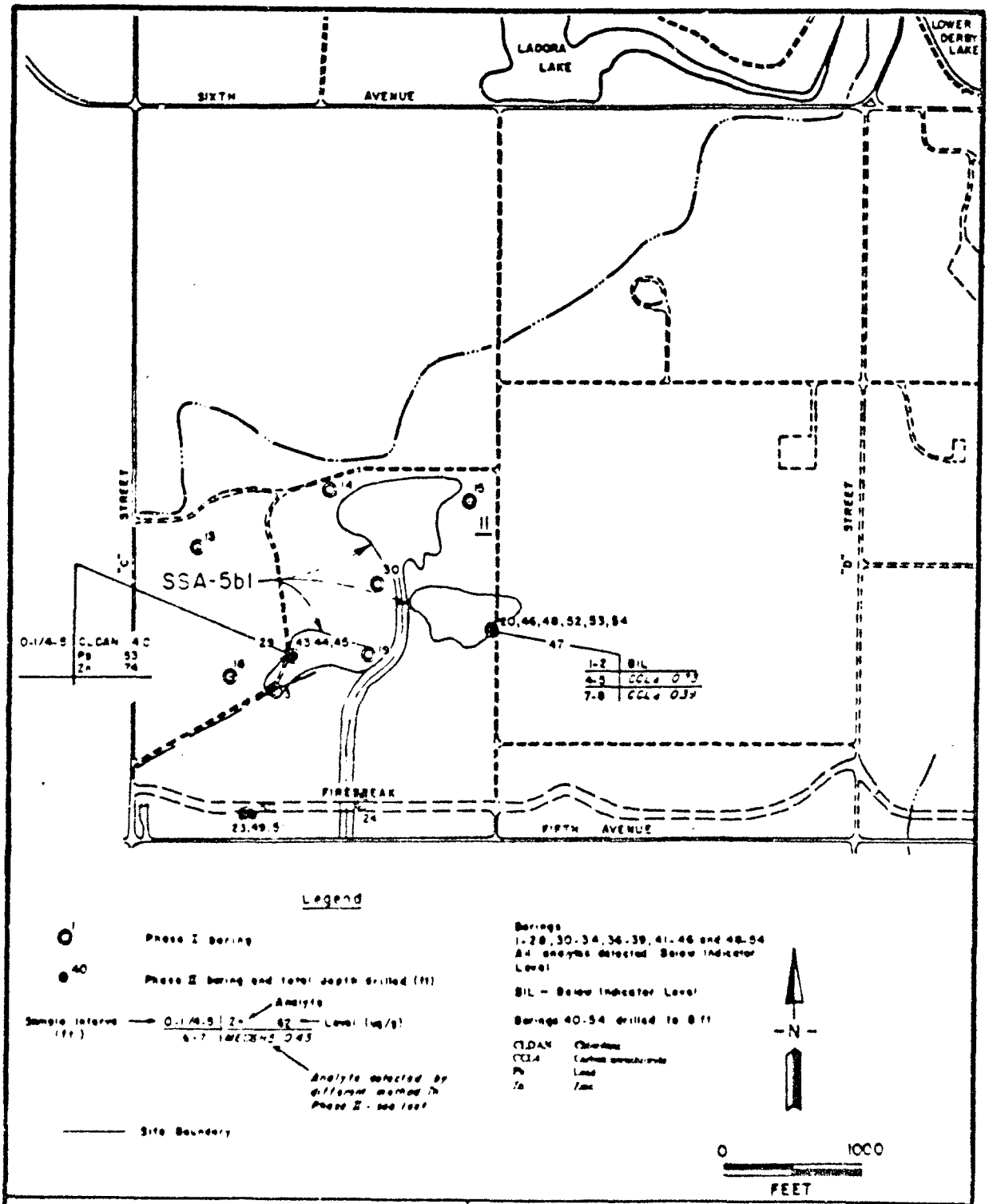
2.14.3 Site Exposure Summary

Tables SSA-5b-2 through SSA-5b-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Chlordane	Direct	Direct	Direct	Direct	Dir/Ind
Carbon tetrachloride	--	--	--	Indirect	Indirect

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

The results of the soil exposure summary indicate that exposure to contamination from the direct and indirect pathways both contribute to the exceedance of the cumulative PPLVs. Site SSA-5b is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-5b-1
Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by Ebasco Services Incorporated

TABLE SSA-5b-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-5b

Contaminant	Horizon 1			Horizon 2		
	Max. (ug/g)	Depth (ft)	Boring Number	Max. (ug/g)	Depth (ft)	Boring Number
Carbon tetrachioride	0.73	4-5	47	0.73	4-5	47
Chlordane	4.0	Comp[1/] 0-1, 4-5	29	4.0	Comp 0-1, 4-5	29
Lead	55	Comp 0-1, 4-5	29	--	--	--

1/ Comp Composite sample from 0-1 ft and 4-5 ft depth intervals.

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-5b-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
CARBON TETRACHLORIDE	2.0E+02	4.6E+05	2.0E+02	3.7E-03	1.6E-06	3.7E-03	0.0E+00
CHLORDANE	2.0E+01	1.0E+10	2.0E+01	2.0E-01*	3.9E-10	2.0E-01*	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	3.4E-03	0.0E+00	3.4E-03	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-5b-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
CARBON TETRACHLORIDE	2.0E+02	4.6E+05	2.0E+02	3.7E-03	1.6E-06	3.7E-03	0.0E+00
CHLORDANE	2.0E+01	1.0E+10	2.0E+01	2.0E-01*	3.9E-10	2.0E-01*	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	3.4E-03	0.0E+00	3.4E-03	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-5b-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
CARBON TETRACHLORIDE	2.7E+01	7.1E+04	2.7E+01	2.7E-02	1.0E-05	2.7E-02	0.0E+00
CHLORDANE	2.7E+00	6.9E+08	2.7E+00	1.5E+00*	5.8E-09	1.5E+00*	0.0E+0U
LEAD	9.2E+03	0.0E+00	9.2E+03	5.7E-03	0.0E+00	5.7E-03	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

SSA-5b-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
CARBON TETRACHLORIDE	2.5E+02	8.8E-01	8.7E-01	3.0E-03	8.3E-01*	8.4E-01*	0.0E+00
CHLORDANE	2.5E+01	1.4E+04	2.5E+01	1.6E-01*	2.9E-04	1.6E-01*	0.0E+00
LEAD	6.5E+03	0.0E+00	6.5E+03	8.1E-03	0.0E+00	8.1E-03	0.0E+00

*: EI is equal to or exceeds 1.0E-01

SSA-5b-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
CARBON TETRACHLORIDE	1.5E+01	6.1E+04	8.8E-01	8.3E-01	4.8E-02	8.3E-01*	8.8E-01*	0.0E+00	0.0E+00
CHLORDANE	1.5E+00	1.4E+09	5.2E+00	1.2E+00	2.6E+00*	7.7E-01*	3.4E+00*	0.0E+00	0.0E+00
LEAD	2.2E+03	0.0E+00	0.0E+00	2.2E+03	2.4E-02	0.0E+00	2.4E-02	0.0E+00	0.0E+00

*: EI is equal to or exceeds 1.0E-01

If the PPLV value indicated is greater than 1.00E+06 the calculations imply that the contaminant does not pose unacceptable chronic exposure through the exposure pathway considered, even in its pure form.

2.15 SITE SSA-5c: SECTION 12 - LEAD DETECTION (formerly Section 12 - Uncontaminated Area; EBASCO, 1987m/RIC 87216R11 and EBASCO, 1988n/RIC 87216R11A)

2.15.1 Site-Specific Considerations

Figure SSA-5c-1 and Table SSA-5c-1 depict the target contaminants for Site SSA-5c. Boring 5 was included in this exposure assessment, consistent with the Southern SAR. According to site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-5c (EBASCO, 1987m/RIC 87216R11).

2.15.2 Spatial Distribution of Measured Contaminant Concentrations

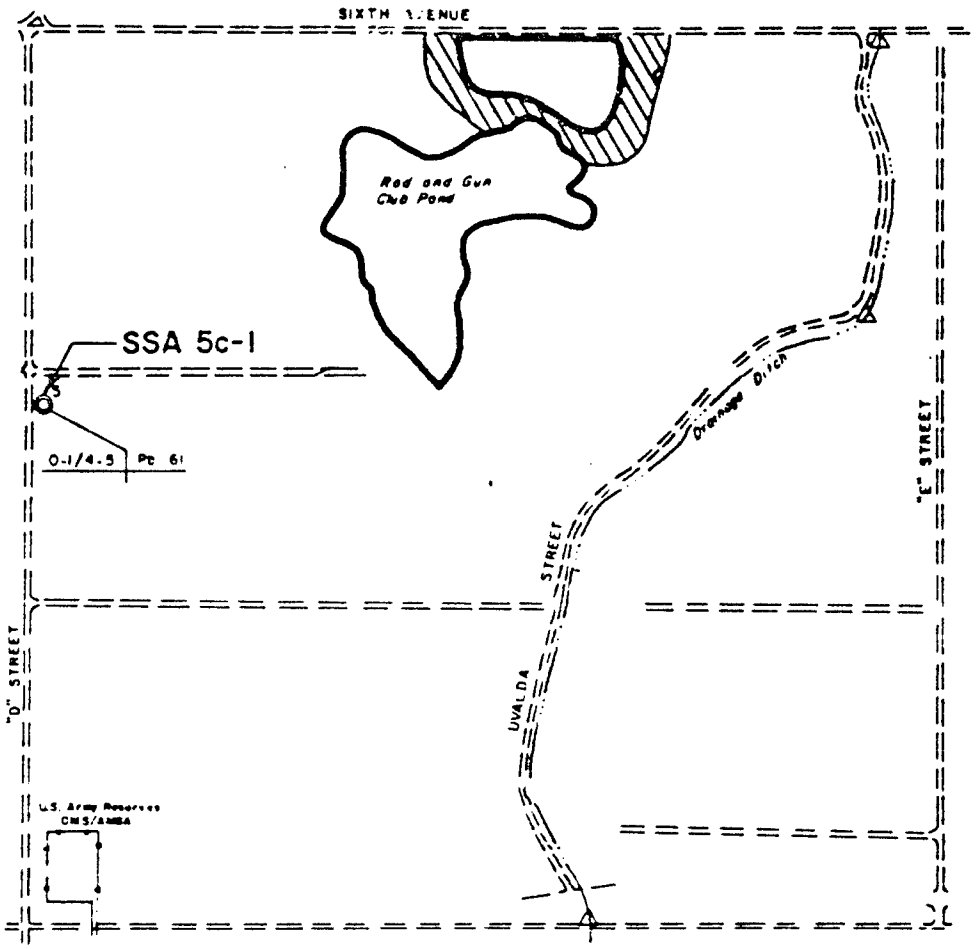
The locations and concentrations of the target contaminants that were detected in Site SSA-5c are shown in Figure SSA-5c-1. Table SSA-5c-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). No organic contaminants were detected at this location. Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

2.15.3 Site Exposure Summary

Tables SSA-5c-2 through SSA-5c-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
None	--	--	--	--	--

The results of the soil exposure summary indicate that there are no COCs. Site SSA-5c is designated as a Priority 2 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Legend

Phase I boring

Pb - Lead

Area sampled by Dames & Moore (1985) by shallow borings (5-15 ft) and deep borings (25 ft) with no contamination detected

Sample interval (ft) — 0-1 | DBCP | 65 — Level (ug/g)

Analyte

N

0 1000

FEET

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-5c-1
Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by Ebasco Services Incorporated

TABLE SSA-5c-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-5c

Contaminant	Horizon 1			Horizon 2		
	Max. (ug/g)	Depth (ft)	Boring Number	Max. (ug/g)	Depth (ft)	Boring Number
Lead	61	Comp[1/] 0-1, 4-5	5	--	--	--

1/ Comp Composite sample from 0-1 ft and 4-5 ft depth intervals.

SSA Southern Study Area
Max. Maximum
ug/g *microgram per gram*
ft foot/feet

SSA-5c-2
EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
LEAD	1.5E+04	0.0E+00	1.5E+04	3.9E-03	0.0E+00	3.9E-03	0.0E+00

SSA-5c-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPH
LEAD	1.5E+04	0.0E+00	1.5E+04	3.9E-03	0.0E+00	3.9E-03	0.0E+00

SSA-5c-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
LEAD	9.2E+03	0.0E+00	9.2E+03	6.6E-03	0.0E+00	6.6E-03	0.0E+00

SSA-5c-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
LEAD	6.5E+03	0.0E+00	6.5E+03	9.4E-03	0.0E+00	9.4E-03	0.0E+00

SSA-5c-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
LEAD	2.2E+03	0.0E+00	0.0E+00	2.2E+03	2.8E-02	0.0E+00	2.8E-02	0.0E+00	0.0E+00

2.16 SITE SSA-5d: SECTION 12 - LEAD DETECTION (formerly Section 12 - Uncontaminated Area; EBASCO, 1987m/RIC 87216R11 and EBASCO, 1988n/RIC 87216R11A)

2.16.1 Site-Specific Considerations

Figure SSA-5d-1 and Table SSA-5d-1 depict the target contaminants for Site SSA-5d. Borings 7, and 34 through 36 were included in this exposure assessment, consistent with the Southern SAR. According to site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-5d (EBASCO, 1987m/RIC 87216R11).

2.16.2 Spatial Distribution of Measured Contaminant Concentrations

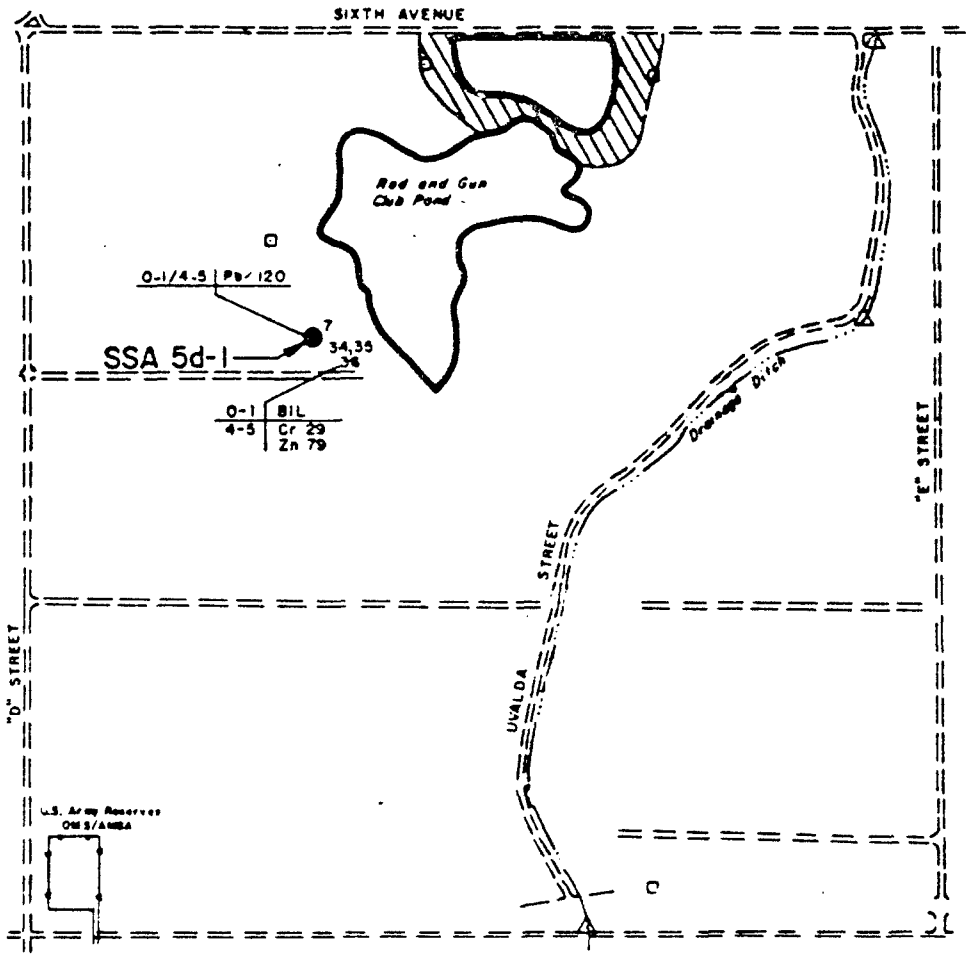
The locations and concentrations of the target contaminants that were detected in Site SSA-5d are shown in Figure SSA-5d-1. Table SSA-5d-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). No organic contaminants were detected at this location. Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

2.16.3 Site Exposure Summary

Tables SSA-5d-2 through SSA-5d-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
None	--	--	--	--	--

The results of the soil exposure summary indicate that there are no COCs. Site SSA-5d is designated as a Priority 2 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Legend

- Phase I boring
- Phase II boring
- Dames & Moore (Well Sampling Points)
- Dames & Moore (Surface Water Sampling Points)
- Area sampled by Dames & Moore (1985) by shallow borings (5-15 ft) and deep borings (25 ft) with no contamination detected

Sample interval (ft) — 0-1 | DBCP — Analyte — 85 — Level (ug/g)

Borings 1-4,6,8-19,21-30,32,34-35,37-41 all analytes detected Below Indicator Level

All Phase II borings drilled to total depth of 5 ft

BIL - Below Indicator Level

Cr - Chromium
Pb - Lead
Zn - Zinc

N

0 1000

FEET

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-5d-1
Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by: Ebasco Services Incorporated

TABLE SSA-5d-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-5d

Contaminant	Horizon 1			Horizon 2		
	Max. (ug/g)	Depth (ft)	Boring Number	Max. (ug/g)	Depth (ft)	Boring Number
Lead	120	Comp[1/] 0-1, 4-5	7	--	--	--

1/ Comp Composite sample from 0-1 ft and 4-5 ft depth intervals.

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-5d-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
LEAD	1.5E+04	0.0E+00	1.5E+04	7.8E-03	0.0E+00	7.8E-03	0.0E+00

SSA-5d-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPM
LEAD	1.5E+04	0.0E+00	1.5E+04	7.8E-03	0.0E+00	7.8E-03	0.0E+00

SSA-5d-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
LEAD	9.2E+03	0.0E+00	9.2E+03	1.3E-02	0.0E+00	1.3E-02	0.0E+00

SSA-5d-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
LEAD	6.5E+03	0.0E+00	6.5E+03	1.8E-02	0.0E+00	1.8E-02	0.0E+00

SSA-5d-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
LEAD	2.2E+03	0.0E+00	0.0E+00	2.2E+03	5.5E-02	0.0E+00	5.5E-02	0.0E+00	0.0E+00

2.17 SITE SSA-5e. SECTION 11 - ULVALDA DITCH (formerly Section 11-Uncontaminated Area; EBASCO, 19871/RIC 87216R10 and EBASCO, 1988m/RIC 87216R10A)

2.17.1 Site-Specific Considerations

Figure SSA-5e-1 and Table SSA-5e-1 depict the target contaminants for Site SSA-5e. Borings 15, 20, 25, 32, 33, 40, and 41 were included in this exposure assessment, consistent with the Southern SAR. According to the site history, no chemicals from the RMA target contaminant list were suspected to be present in Site SSA-5e (EBASCO 19871/RIC 87216R10).

2.17.2 Spatial Distribution of Measured Contaminant Concentrations

The locations and concentrations of the target contaminants that were detected in Site SSA-5e are shown in Figure SSA-5e-1. Table SSA-5e-1 summarizes the maximum concentrations of contaminants measured in soil above indicator levels for the ICP metals, arsenic, and mercury and CRLs for organic contaminants from the Phase I and Phase II investigations. The boring number and depth where the maximum value was observed are shown. No data were included for ICP metals, arsenic, and mercury in Horizon 2 because direct soil exposure below 10 ft is assumed to be negligible (see Volume VI-A). Based on available groundwater data from the first quarter 1987 to the first quarter 1989 sampling period, no evidence of groundwater contamination beneath this site was found (see Volume VI-A).

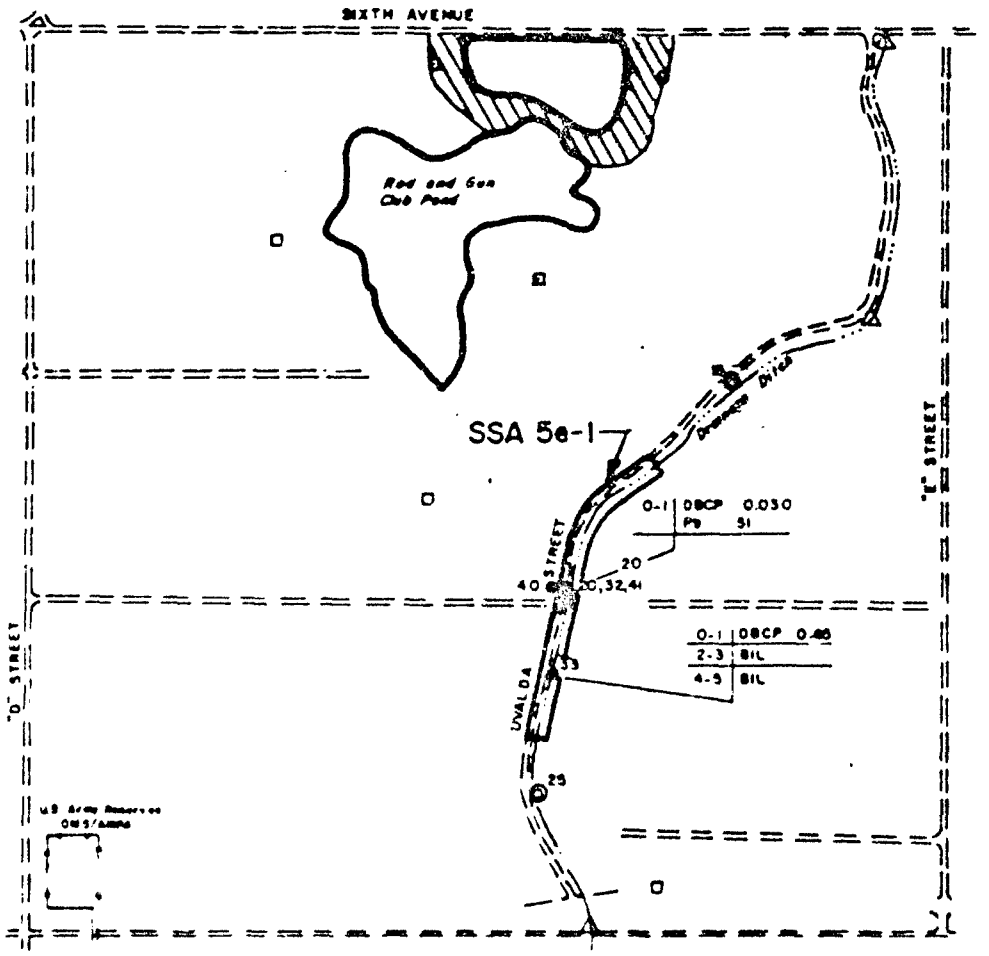
2.17.3 Site Exposure Summary

Tables SSA-5e-2 through SSA-5e-6 present Draft PPLVs and EIs for each site contaminant. The COCs are summarized below for each exposed population and with the critical exposure pathway identified.

Contaminants of Concern	Regulated Visitor	Casual Visitor	Recreational Visitor	Commercial Worker	Industrial Worker
Dibromochloropropane	--	--	Direct	Indirect	Dir/Ind

Note: Direct exposure pathways for soils include soil ingestion, suspended particulate inhalation, and dermal contact.
Indirect exposure pathways include open and enclosed space vapor inhalation.

The results of the soil exposure summary indicate that exposure to contamination from the direct and indirect pathways both contribute to the exceedance of the cumulative PPLVs. Site SSA-5e is designated as a Priority 1 site, based on the most sensitive exposed population PPLV (i.e., the industrial worker).



Prepared for

Program Managers Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground, Maryland

FIGURE SSA-5e-1
Phase I and Phase II Analytes Detected Within or Above Indicator Levels

Rocky Mountain Arsenal

Prepared by Ebasco Services Incorporated

TABLE SSA-5e-1
SOIL CONTAMINANT CONCENTRATIONS
FOR SITE SSA-5e

Contaminant	Horizon 1			Horizon 2		
	Max. (ug/g)	Depth (ft)	Boring Number	Max. (ug/g)	Depth (ft)	Boring Number
Dibromochloropropane	0.65	0-1	33	0.65	0-1	33
Lead	51	0-1	20	--	--	--

SSA Southern Study Area
Max. Maximum
ug/g microgram per gram
ft foot/feet

SSA-5e-2

EXPOSURE EVALUATIONS FOR REGULATED VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
DIBROMOCHLOROPROPANE	1.8E+01	8.7E+05	1.8E+01	3.6E-02	7.4E-07	3.6E-02	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	3.3E-03	0.0E+00	3.3E-03	0.0E+00

SSA-5e-3

EXPOSURE EVALUATIONS FOR CASUAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
DIBROMOCHLOROPROPANE	1.8E+01	8.7E+05	1.8E+01	3.6E-02	7.4E-07	3.6E-02	0.0E+00
LEAD	1.5E+04	0.0E+00	1.5E+04	3.3E-03	0.0E+00	3.3E-03	0.0E+00

SSA-5e-4

EXPOSURE EVALUATIONS FOR RECREATIONAL VISITORS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN
DIBROMOCHLOROPROPANE	2.5E+00	1.4E+05	2.5E+00	2.6E-01*	4.8E-06	2.6E-01*	0.0E+00
LEAD	9.2E+03	0.0E+00	9.2E+03	5.5E-03	0.0E+00	5.5E-03	0.0E+00

*: EI is equal to or exceeds 1.0E-01

SSA-5e-5

EXPOSURE EVALUATIONS FOR COMMERCIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT PPLV (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI ENC
DIBROMOCHLOROPROPANE	2.3E+01	4.8E+00	3.9E+00	2.9E-02	1.4E-01*	1.6E-01*	0.0E+00
LEAD	6.5E+03	0.0E+00	6.5E+03	7.8E-03	0.0E+00	7.8E-03	0.0E+00

*: EI is equal to or exceeds 1.0E-01

SSA-5e-6

EXPOSURE EVALUATIONS FOR INDUSTRIAL WORKERS

CONTAMINANT	DIRECT PPLV (mg/kg)	INDIRECT OSVI (mg/kg)	INDIRECT ESVI (mg/kg)	CUMULATIVE PPLV (mg/kg)	DIRECT EI	INDIRECT EI	CUMULATIVE EI	VEI OPN	VEI ENC
DIBROMOCHLOROPROPANE	1.4E+00	1.2E+05	4.8E+00	1.1E+00	4.6E-01*	1.4E-01*	6.0E-01*	0.0E+00	0.0E+00
LEAD	2.2E+03	0.0E+00	0.0E+00	2.2E+03	2.3E-02	0.0E+00	2.3E-02	0.0E+00	0.0E+00

*: EI is equal to or exceeds 1.0E-01

3.0 STUDY AREA EXPOSURE SUMMARY

The exposure assessment results for the SSA at RMA are summarized in Table 3-1. Of the 17 sites evaluated, 13 sites were designated as Priority 1 sites based on the most sensitive exposed population PPLV (i.e., the industrial worker). These include:

- Eastern Upper Derby Lake (SSA-1a)
- Upper Derby Lake (SSA-1b)
- Lower Derby Lake (SSA-1c)
- Rod and Gun Club Pond (SSA-1d)
- Lake Ladora (SSA-1e)
- Drainage Ditches (SSA-2a)
- Sand Creek Lateral (SSA-2b)
- Drainage Ditch and Overflow Basin (SSA-2c)
- Buried Lake Sludge (SSA-3a)
- Buried Lake Sludge (SSA-3b)
- Trash Dump (SSA-4)
- Havana/Peoria Streets - Ponds and Ditches (SSA-5b)
- Section 11 - Ulvalda Ditch (SSA-5e).

Four sites were designated as Priority 2 sites based on the most sensitive exposed population PPLV (i.e., the industrial worker). These include:

- Lake Mary (SSA-1f)
- Section 1 - Dibromochloropropane Detection (SSA-5a)
- Section 12 - Lead Detection (SSA-5c)
- Section 12 - Lead Detection (SSA-5d).

The COCs in soils and sediments (i.e., those displaying an EI greater than 0.1) for the SSA, based on the most sensitive exposed population PPLV (i.e., the industrial worker), are:

- Aldrin
- Carbon tetrachloride
- Chlordane

- Dibromochloropropane
- Dieldrin
- PPDDE
- PPDDT
- Hexachlorocyclopentadiene
- Isodrin
- Methylene chloride
- 1,1,2,2-Tetrachloroethane
- Arsenic
- Chromium
- Lead

No COSs in groundwater (i.e., those displaying a VEI greater than 1) were identified for the SSA.

TABLE 3-1
NUMBER OF EXCEEDANCES FOR CONTAMINANTS OF CONCERN
IN THE SOUTHERN STUDY AREA

Contaminant of Concern	Number of Exceedances
Aldrin	8
Carbon tetrachloride	1
Chlordane	6
Dibromochloropropane	2
Dieldrin	9
PPDDE	3
PPDDT	3
Hexachlorocyclopentadiene	1
Isodrin	1
Methylene chloride	2
1,1,2,2-Tetrachloroethane	4
Arsenic	3
Chromium	2
Lead	1

4.0 REFERENCES

RIC 87196R03

EBASCO (EBASCO Services Incorporated). 1987a. Final Phase I Contamination Assessment Report. Site 6-2: Eastern Upper Derby Lake (Upper Derby Lake Overflow). Version 3.2. May 1987. Task No. 12 - Derby Lakes Area. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87196R02

EBASCO. 1987b. Final Phase I Contamination Assessment Report. Site 1-2: Upper and Lower Derby Lakes. Version 3.2. June 1987. Task No. 12 - Derby Lakes Area. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87127R04

EBASCO. 1987c. Final Phase I Contamination Assessment Report. Site 12-2: Rod and Gun Club Pond. Version 3.3. April 1987. Task No. 12 - Derby Lakes Area. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87216R07

EBASCO. 1987d. Final Phase I Contamination Assessment Report. Site 2-17: Lake Ladora and Lake Mary. Version 3.2. July 1987. Task No. 7 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87196R01

EBASCO. 1987e. Final Phase I Contamination Assessment Report. Site 1-1: Drainage Ditches. Version 3.4. May 1987. Task No. 7 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87216R06

EBASCO. 1987f. Final Phase I Contamination Assessment Report. Site 2-1: Drainage Ditches. Version 3.3. July 1987. Task No. 7 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87336R12

EBASCO. 1987g. Final Phase I Contamination Assessment Report. Site 3-2/3-3: Drainage Ditch and Overflow Basin. Version 3.2. December 1987. Task No. 7 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87196R04
EBASCO. 1987h. Final Phase I Contamination Assessment Report. Site 11-1: Buried Lake Sludge. Version 3.3. June 1987. Task No. 12 - Derby Lakes Area. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 88096R01
EBASCO. 1987i. Final Phase I Contamination Assessment Report. Site 12-1: Buried Lake Sludge. Version 3.2. December 1987. Task No. 12 - Derby Lakes Area. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87127R03
EBASCO. 1987j. Final Phase I Contamination Assessment Report. Site 1-12: Trash Dump. Version 3.2. April 1987. Task No. 12 - Derby Lakes Area. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87127R05
EBASCO. 1987k. Final Phase I Contamination Assessment Report. Section 1-Uncontaminated Area. Version 3.3. April 1987. Task No. 7 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87216R10
EBASCO. 1987l. Final Phase I Contamination Assessment Report. Section 11-Uncontaminated Area. Version 3.1. July 1987. Task No. 15 - Army Sites-South. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87216R11
EBASCO. 1987m. Final Phase I Contamination Assessment Report. Section 12-Uncontaminated Area. Version 3.2. July 1987. Task No. 15 - Army Sites-South. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87196R03A
EBASCO. 1988a. Site 6-2: Eastern Upper Derby Lake (Upper Derby Lake Overflow). Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 88357R01
EBASCO. 1988b. Proposed Final Rocky Mountain Arsenal Chemical Index Volumes I-II. August 1988. Contract No. DAAK11-84. Prepared for: Program Manager's Office for RMA Contamination Cleanup.

RIC 87196R02A
EBASCO. 1988c. Final Phase II Data Addendum. Site 1-2: Upper and Lower Derby Lakes. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87127R04A
EBASCO. 1988d. Final Phase II Data Addendum. Site 12-2: Rod and Gun Club Pond. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK1-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87216R07A
EBASCO. 1988e. Final Phase II Data Addendum. Site 2-17: Lake Ladora and Lake Mary. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87196R01A
EBASCO. 1988f. Final Phase II Data Addendum. Site 1-1: Drainage Ditches. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87216R06A
EBASCO. 1988g. Final Phase II Data Addendum. Site 2-1: Drainage Ditches. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87336R12A
EBASCO. 1988h. Final Phase II Data Addendum. Site 3-2/3-3: Drainage Ditch and Overflow Basin. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87196R04A
EBASCO. 1988i. Final Phase II Data Addendum. Site 11-1: Buried Lake Sludge. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 88096R01A
EBASCO. 1988j. Final Phase II Data Addendum. Site 12-1: Buried Lake Sludge. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87127R03A
EBASCO. 1988k. Final Phase II Data Addendum. Site 1-12: Trash Dump. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87127R06A
EBASCO. 1988l. Final Phase II Data Addendum. Section 1-Uncontaminated Area. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87216R10A
EBASCO. 1988m. Final Phase II Data Addendum. Section 11-Uncontaminated Area. Version 3.1. October 1988. Task No. 22 - Army Sites South. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 87216R11A
EBASCO. 1988n. Final Phase II Data Addendum. Section 12-Uncontaminated Area. Version 3.1. October 1988. Task No. 20 - Lower Lakes. Contract No. DAAK11-84-D-0017. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup.

RIC 88196R08
EBASCO. 1989a. Final Remedial Investigation Report. Volume VI. Southern Study Area. Version 3.3. June 1989. Contract No. DAAAK15-88-D-0024. Prepared for: U.S. Army Program Manager's Office for RMA Contamination Cleanup. Thibodeaux, L.J. and S.T. Hwang. 1982. Landfarming of Petroleum Wastes - Modeling the Air Emissions Problem. Environmental Progress. 1:42.

APPENDIX A
NONTARGET SCREENING

NONTARGET SCREENING

A number of nontarget contaminants were originally identified through a screen (i.e., toxicity, concentration, frequency of occurrence) of the nontarget fraction of the Phases I and II RI data as part of the RMA Chemical Index (EBASCO, 1988b/RIC88357R01). These contaminants were carried through to the exposure assessment where an additional screening was performed to determine whether PPLVs should be developed for each of the site-specific nontarget contaminants. Development of PPLVs for these contaminants was based on four screening criteria, namely, frequency of occurrence, similarity of the nontarget concentration to that of target contaminants, suspicion that the detection was a laboratory contaminant, and co-occurrence of nontargets with targets in Arsenal soils (see Volume VI-A, Section 2.2.3.1).

The results of the nontarget evaluations for each site of Southern Study Area, their screening parameters, and the decision to further consider or reject them, are presented in Table A-1.

TABLE A-1
SOUTHERN STUDY AREA NONTARGET SCREENING

Site	Nontarget Contaminant	Frequency of Occurrence	Relative Concentration	Suspected Lab Contam.	Co-occurs with Drivers	Nontarget Decision
SSA-1a	1,1,2,2-Tetrachloroethane	Low	High	No	Yes	Defer[1/]
SSA-1b	1,1,2,2-Tetrachloroethane	Low	Low	No	Yes	Reject[1/]
SSA-1d	1,1,2,2-Tetrachloroethane	Moderate	High	No	Yes	Develop PPLV
SSA-2c	1,1,2,2-Tetrachloroethane	Moderate	High	No	Yes	Develop PPLV

1/ Although rejected or deferred, PPLVs were computed for this chemical since it was detected on Sites SSA-1d and SSA-2c.

APPENDIX B

OPEN SPACE VAPOR INHALATION PATHWAY SCREENING ANALYSIS FOR SOUTHERN STUDY AREA LAKE SITES

OPEN SPACE VAPOR INHALATION PATHWAY
SCREENING ANALYSIS FOR SOUTHERN STUDY AREA LAKE SITES

In order to determine the significance of inhalation of vaporized contaminants through surface water bodies from lake sediments, a screening analysis was performed. The screen consisted of two types of analyses: (1) a worst-case estimate of ambient air concentrations was obtained through equilibrium partitioning and (2) for those chemicals for which the equilibrium concentrations computed from (1) above exceeded their allowable air concentration (AAC) by more than one order of magnitude, a more elaborate model (EPA, 1988) was used. These analyses are described below.

SIMPLE EQUILIBRIUM PARTITIONING

Equilibrium partitioning of the contaminants between sediments and water and between water and air was assumed. This method gives very conservative estimates of the ambient air contaminant levels, since it predicts instantaneous equilibrium air concentrations with no aqueous dilution or wind dispersion. The mathematical computations for this worst-case estimate scenario are shown below.

Using the simple equilibrium relationships,

$$C_{air} = (H/R * T) * C_w \qquad (1)$$

where

C_{air} = contaminant concentration in air
H = Henry's Law constant
R = universal gas constant
T = temperature
C_w = contaminant concentration in water

$$C_w = \frac{C_{sed}}{K_d} \qquad (2)$$

where

C_{sed} = contaminant concentration in sediment

K_d = site-specific sediment/water partitioning coefficient

$$K_d = Koc * Foc \quad (3)$$

where

Koc = soil to water partition coefficient normalized to organic carbon

Foc = fraction of organic carbon in soil

and rearranging and combining equations (1) through (3) with proper unit conversions

$$C_{air}\ (mg/m^3) = \frac{C_{sed} * H * 1000\ l/m^3}{Koc * Foc * R * T} \quad (4)$$

where all variables are the same as defined earlier.

The following data were used, based upon average contaminant concentrations reported in the sediment.

Site	Contaminant	C_{sed} (mg/kg)	H	Koc
SSA-1b	Aldrin	0.064	1.60E-05	46,875
SSA-1b	Chlordane	0.21	9.63E-06	140,600
SSA-1b	PPDDE	0.016	6.80E-05	92,661
SSA-1b	PPDDT	0.036	5.13E-04	302,000
SSA-1b	Dieldrin	0.041	4.58E-07	7,179
SSA-1b	Endrin	0.028	4.20E-06	7,494
SSA-1b	Hexachlorocyclopentadiene	0.02	1.37E-02	11,534
SSA-1b	Isodrin	0.072	1.70E-04	38,220

Site	Contaminant	C_{soil} (mg/kg)	H	Koc
SSA-1c	Aldrin	0.048	1.60E-05	46,875
SSA-1c	Chlordane	0.11	9.63E-06	140,600
SSA-1c	PPDDE	0.0072	6.80E-05	92,661
SSA-1c	PPDDT	0.0081	5.13E-04	302,000
SSA-1c	Dieldrin	0.013	4.58E-07	7,179
SSA-1c	Endrin	0.038	4.20E-06	7,494
SSA-1c	Dibromochloropropane	0.053	3.30E-04	255
SSA-1c	Isodrin	0.014	1.70E-04	38,220
SSA-1e	Aldrin	0.016	1.60E-05	46,875
SSA-1e	PPDDE	0.015	6.80E-05	92,661
SSA-1e	PPDDT	0.036	5.13E-04	302,000
SSA-1e	Dibromochloropropane	0.031	3.30E-04	255
SSA-1e	Dieldrin	0.05	4.58E-07	7,179
SSA-1e	Endrin	0.0078	4.20E-06	7,494
SSA-1e	Isodrin	0.019	1.70E-04	38,220
SSA-1e	Methylene chloride	1.7	2.03E-02	16
SSA-1e	Methylisobutyl ketone	1	1.10E-04	4
SSA-1e	Tetrachloroethylene	1	2.59E-02	362
SSA-1e	1,1,1-Trichloroethane	0.6	1.44E-02	217
SSA-1f	Aldrin	0.0049	1.60E-05	46,875
SSA-1f	PPDDE	0.0071	6.80E-05	92,661
SSA-1f	PPDDT	0.015	5.13E-04	302,000

Using equation (4), the predicted equilibrium air concentrations were computed and are given below, together with the AAC values for an industrial worker, which were computed as discussed in Volume IV, Section 4.6.1.

Site	Contaminant	C_{air} (mg/m^3)	AAC (mg/m^3)
SSA-1b	Aldrin	2.71E-04*	1.69E-06
SSA-1b	Chlordane	1.78E-04	2.21E-05
SSA-1b	PPDDE	1.46E-04	8.31E-05
SSA-1b	PPDDT	7.58E-04	8.31E-05
SSA-1b	Dieldrin	3.24E-05*	1.78E-06
SSA-1b	Endrin	1.95E-04	8.60E-03
SSA-1b	Hexachlorocyclopentadiene	2.95E-01*	1.89E-03
SSA-1b	Isodrin	3.97E-03	2.01E-03

Site	Contaminant	C_{air} (mg/m³)	AAC (mg/m³)
SSA-1c	Aldrin	2.03E-04*	1.69E-06
SSA-1c	Chlordane	9.34E-05	2.21E-05
SSA-1c	PPDDE	6.55E-05	8.31E-05
SSA-1c	PPDDT	1.71E-04	8.31E-05
SSA-1c	Dieldrin	1.03E-05	1.78E-06
SSA-1c	Endrin	2.64E-04	8.60E-03
SSA-1c	Dibromochloropropane	8.51E-01*	2.03E-05
SSA-1c	Isodrin	7.72E-04	2.01E-03
SSA-1e	Aldrin	6.77E-05*	1.69E-06
SSA-1e	PPDDE	1.37E-04	8.31E-05
SSA-1e	PPDDT	7.58E-04	8.31E-05
SSA-1e	Dibromochloropropane	4.97E-01*	2.03E-05
SSA-1e	Dieldrin	3.96E-05*	1.78E-06
SSA-1e	Endrin	5.42E-05	8.60E-03
SSA-1e	Isodrin	1.05E-03	2.01E-03
SSA-1e	Methylene chloride	2.67E-04*	2.03E-03
SSA-1e	Methylisobutyl ketone	3.41E-02*	5.73E-01
SSA-1e	Tetrachloroethylene	8.87E-02*	8.60E-03
SSA-1e	1,1,1-Trichloroethane	4.94E-02*	8.60E+00
SSA-1f	Aldrin	2.07E-05*	1.69E-06
SSA-1f	PPDDE	6.46E-05	8.31E-05
SSA-1f	PPDDT	3.16E-04	8.31E-05

* Estimated C_{air} significantly exceeds the AAC.

Comparing C_{air} to the chemical-specific AACs, the vapor pathway through the surface water bodies was then shown to be insignificant (ratio is much less than 1), marginal (ratio is within a factor of 10), or significant (ratio is much greater than 1). For those contaminants which exhibited significant exceedances based on the simple equilibrium assumptions (e.g., Aldrin and Dieldrin), the second analysis was performed.

EXTENDED PARTITIONING MODEL

This procedure entailed (1) computing a contaminant emission rate (E_i) through the use of the mass transfer model described in the EPA Superfund Exposure Assessment Manual (EPA, 1988), (2) using the ISCLT computer model to determine a site-specific wind

dispersion factor (X/F_o), and (3) calculating the estimated air concentration and comparing this value to the AAC as described in the previous screen. These analyses are detailed below.

Computation of Contaminant Emission Rate (E_i) - The contaminant emission rate (E_i) in units of mg/cm²-sec was calculated using the following relationships.

$$E_i = K_i * C_w + 10 \quad (5)$$

where

K_i = mass transfer coefficient of contaminant i

where K_i is the overall mass transfer coefficient in cm/sec. C_w was calculated by simple equilibrium partitioning as

$$C_w = \frac{C_{sed}}{K_d} \quad (6)$$

where C_w, C_{sed}, and K_d are as defined earlier.

K_i is calculated as:

$$K_i = \frac{1}{\frac{1}{K_{il}} + \frac{R * T}{K_H * K_{ig}}} \quad (7)$$

where K_{ig} is the gas phase mass transfer coefficient of contaminant i and K_{il} is the liquid phase mass transfer coefficient of contaminant i, calculated as:

$$K_{il} = \left(\frac{MW_o}{MW_i}\right)^{0.5} * \frac{T}{298} * K_{lo} \quad (8)$$

where

H, R, and T are as defined earlier

MW_o = molecular weight of oxygen (16 g/g-mole)

MW_i = molecular weight of contaminant i

$K_{l,o}$ = liquid phase mass transfer coefficient of oxygen in units of cm/sec

Weber (1972) computed $K_{l,o}$ as

$$K_{l,o} = 32.3 * (1.018)^{T_c-20} * 2.7 \times 10^{-4} \quad (9)$$

where

T_c = temperature in degrees Celcius (25°C)

$K_{i,g}$ in equation (7) is the gas phase mass transfer coefficient in units of cm/sec and is expressed as:

$$K_{i,g} = \left(\frac{MW_w}{MW_i}\right)^{0.335} * \left(\frac{T}{298}\right)^{1.005} * K_{i,g,w} \quad (10)$$

where

MW_w = molecular weight of water (18 g/g-mole)

$K_{i,g,w}$ = gas phase mass transfer coefficient of contaminant i in water (5.8×10^{-5} g-mol/cm^2-sec; Hwang, 1982)

In order to use the value of $K_{i,g,w}$ in equation (10), it must be converted into units of cm/sec. This manipulation is shown below and results in a value of 1.04×10^{-3} cm/sec, where ρ_w is the density of water (1 g/cm^3).

$$K_{i,g,w} = 5.8 \times 10^{-5} \text{ g-mol/cm}^2\text{-sec} * \frac{MW_w}{\rho_w} \quad (11)$$

Solving equations (5) through (11) for the contaminants exceeding their AACs in the first screen, the E_i values were determined. These values are listed below, along with the chemical-specific parameters described above.

Site	Contaminant	C_{ss} (mg/kg)	H	Koc	MW	Ei
SSA-1b	Aldrin	0.064	1.60E-05	46,875	365	1.93E-09
SSA-1b	Dieldrin	0.041	4.58E-07	7,179	381	1.21E-10
SSA-1b	Hexachlorocyclopentadiene	0.02	1.37E-02	11,534	275	1.12E-06
SSA-1c	Aldrin	0.048	1.60E-05	46,875	365	7.71E-10
SSA-1c	Dibromochloropropane	0.053	3.30E-04	255	236	3.73E-06
SSA-1e	Aldrin	0.016	1.60E-05	46,875	365	2.57E-10
SSA-1e	Dibromochloropropane	0.031	3.30E-04	255	236	2.18E-06
SSA-1e	Dieldrin	0.05	4.58E-07	7,179	381	1.48E-10
SSA-1e	Methylene chloride	1.7	2.03E-02	16	85	1.47E-01
SSA-1e	Methylisobutyl ketone	1	1.10E-04	4	100	2.00E-03
SSA-1e	Tetrachloroethylene	1	2.59E-02	362	166	3.72E-03
SSA-1e	1,1,1-Trichloroethane	0.6	1.44E-02	217	133	2.40E-03
SSA-1f	Aldrin	0.0049	1.60E-05	46.875	365	7.87E-11

Compute the Site-Specific Wind Dispersion Factor (X/F_o) - The wind dispersion factor is computed through the use of the Industrial Source Complex Long Term (ISCLT) model (EPA, 1987, 1986b) as described in Volume IV, Section 4.6. The values used for the four lake sites in the Southern Study Area are listed along with estimated air concentration.

Estimation of the Contaminant Concentration in Air (C_{av}) - The air concentration is computed as follows:

$$C_{av} = E_i * (X/F_o) \qquad (12)$$

Comparing the resulting values for C_{av} to the contaminant-specific recreational land use AAC shown below, the significance of this pathway can be evaluated. These values show that the vapor pathway for lake sites in the Southern Study Area is insignificant.

Site	Contaminant	X/F$_a$	C$_{av}$	AAC
SSA-1b	Aldrin	2.31E-05	2.38E-14	1.69E-06
SSA-1b	Dieldrin	2.31E-05	2.81E-15	1.78E-06
SSA-1b	Hexachlorocyclopentadiene	2.31E-05	2.59E-11	1.89E-03
SSA-1c	Aldrin	1.13E-06	8.71E-16	1.69E-06
SSA-1c	Dibromochloropropane	1.13E-06	4.21E-12	2.03E-05
SSA-1e	Aldrin	8.78E-06	2.26E-15	1.69E-06
SSA-1e	Methylene chloride	8.78E-06	1.29E-06	2.03E-03
SSA-1e	Methylisobutyl ketone	8.78E-06	1.75E-08	5.73E-01
SSA-1e	Tetrachloroethylene	8.78E-06	3.27E-08	8.60E-03
SSA-1e	1,1,1-Trichloroethane	8.78E-06	2.11E-08	8.60E+00
SSA-1f	Aldrin	8.73E-05	6.87E-15	1.69E-06

APPENDIX C
SOUTHERN STUDY AREA

Appendix C
Southern Study Area

One site in this study area had exceedances of the open space vapor inhalation pathway: SSA-2b. According to the methodology presented in Volume IV, Section 4.5.8, the representative exposure index (EI_{REP}) was calculated using the mean soil contaminant concentration at the site for the specific contaminant(s) in question.

The mean soil contaminant concentrations were calculated as the geometric mean of the hits for contaminants with less than 30 percent hits and the adjusted geometric mean of the hits for contaminants with greater than 30 percent hits. This procedure was adopted to ensure the most conservative computation of the mean values.

The EI_{REP} was then calculated using the lowest open space SPPPLV calculated for a particular contaminant at the site. The open space SPPPLVs used were either recreational (Rec) and industrial (Ind). EI_{REP}'s with values greater than 0.1 are exceedances and are designated with an asterisk. The sites, contaminants, SPPPLVs, mean concentrations, and EI_{REP}'s are listed in Table C-1.

There were no EI_{REP} exceedances for this study area.

TABLE C-1
SOUTHERN STUDY AREA EI_{REP}'s

Site	Contaminant	SPPPLV (ug/kg)	Mean Concentrations (ug/kg)	EI_{REP}
SSA-2b	Aldrin	280 Ind[1/]	2.5	9.0×10^{-3}
	Dieldrin	1,300 Ind	1.1	7.7×10^{-4}

1/ Ind denotes that the industrial worker SPPPLV was used to calculate EI_{REP}.